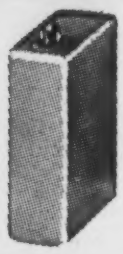
See page 5

March

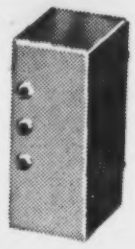
For Your Special Applications

The bulk of UTC production is on special units designed to specific customers' needs. Illustrated below are some typical units and some unusual units as manufactured for special applications. We would be pleased to advise and quote to your special requirements.

FILTERS
All types for frequencies from .1 cycle to 400 MC.

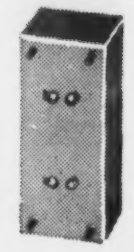


400 ⁓ telemetering, 3 db at ± 7.5%, 40 db at 230 and 700 ⁓, ⅝ x 1¼ x 2".

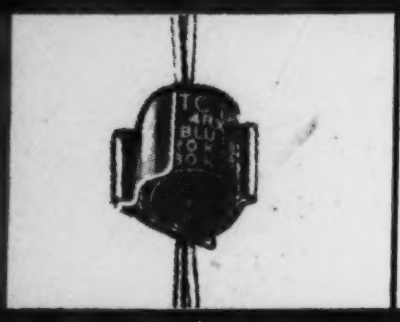


15 ⁓ BP filter, 20 db at 30 ⁓, 45 db at 100 ⁓, phase angle at CF less than 3° from —40 to + 100° C.

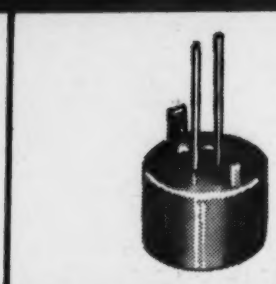
LP filter within 1 db to 49 KC, stable to .1 db from 0 to 85° C., 45 db at 55 KC.



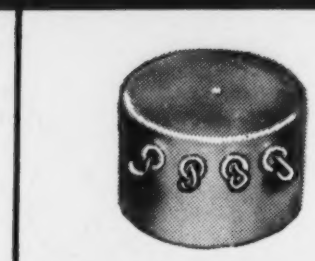
LP filter less than .1 db 0 to 2.5 KC, 50 db beyond 3 KC.



Tuned DO-T servo amplifier transformer, 400 — .5% distortion.



Toroid for printed circuit, Q of 90 at 15 KC.



Dual toroid, Q of 75 at 10 KC, and Q of 120 at 5 KC.

HVC tapped variable inductor for 3 KC oscillator.

HIGH Q COILS
Toroid, laminated, and cup structures from .1 cycle to 400 MC.

SPECIALTIES
Saturable reactors, reference transformers, magnetic amplifiers, combined units.

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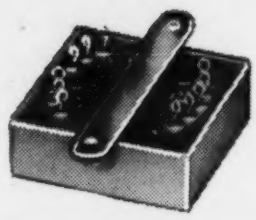
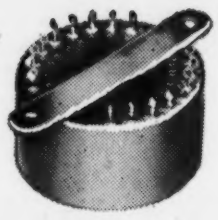
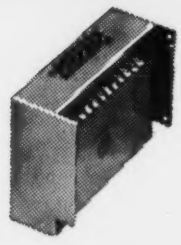


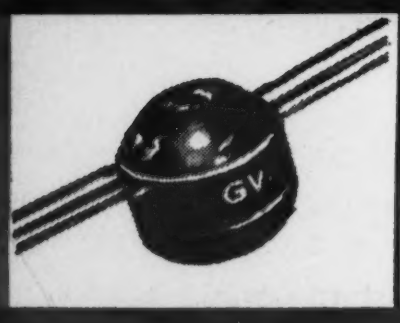
Voltage reference transformer .05% accuracy.



Multi-control magnetic amplifier for airborne servo.

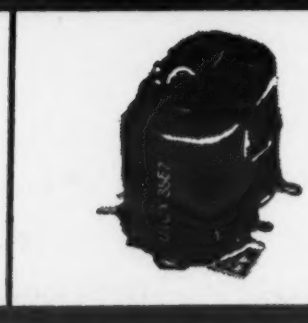


Input, output, two tuned interstages, peaking network, and BP filter, all in one case.

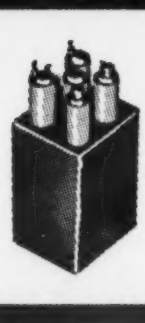


Wound core unit .01 microsecond rise time.

Pulse current tansformer 100 Amp.



Pulse output to magnstron, bifilar filament.



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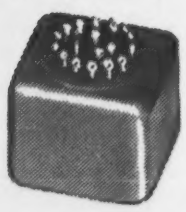
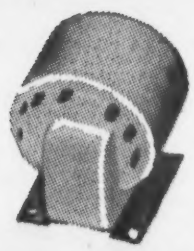
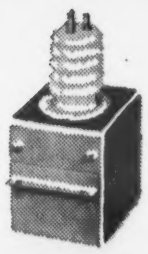


Multi-winding 140 VA, 5 KC power transformer 1¼ x 1¼ x 1"



200° C. power transformer, 400 ⁓, 150 VA.

400 ⁓ scope transformer, 20 KV output.



60 ⁓ current limiting filament transformer, Sec. 25 Mmfd., 30 KV hipot.

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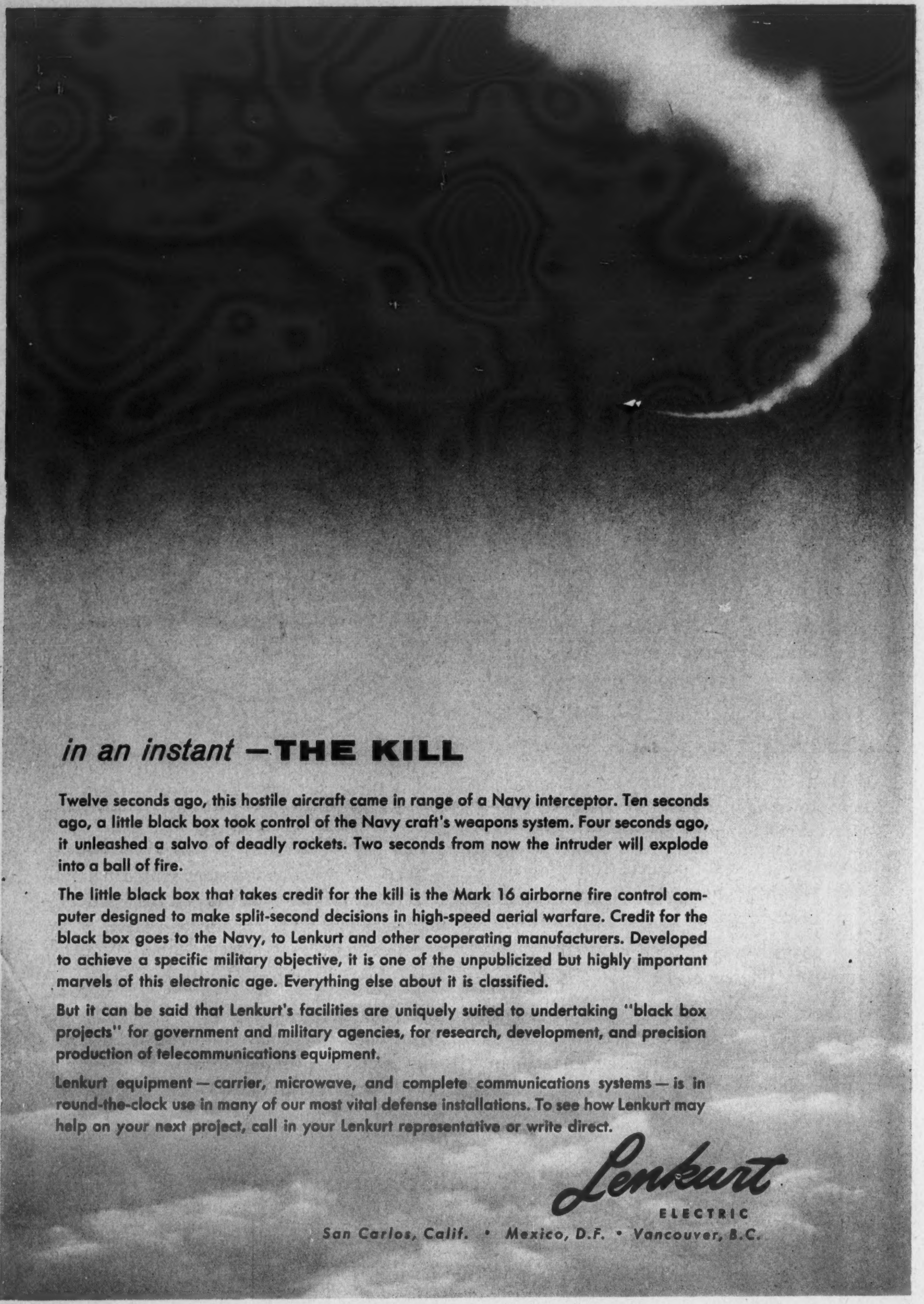
—And an attitude and spirit of service that our customers have come to know as a most important part of the Bell System idea.

Bell Telephone System



in an instant —THE KILL

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BPA

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Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

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*This feature article represents a continuation of the Stockpile Concept for 1958. (See the January 1958 issue.)

Cover Picture

Dr. Wernher von Braun (left) and Alexander P. de Seversky discussing a model of the Explorer satellite at the Military-Industrial Conference, Chicago, Feb. 25, 1958. "A US Army Photograph," taken by M/Sgt. Joseph Moroz, Jr., Signal Services, Hqs., 5th U. S. Army.

SIGNAL will feature a story on "National Aims and Space Power" by Major de Seversky in the April issue.

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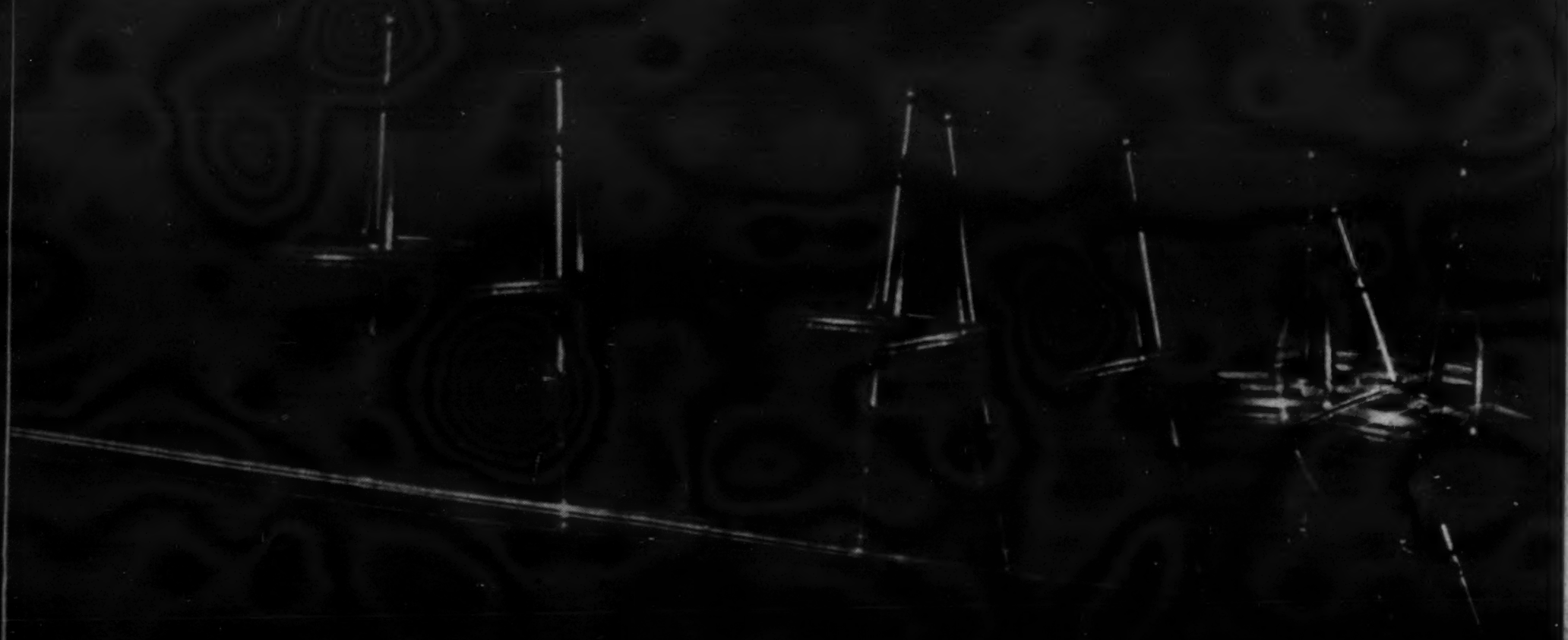
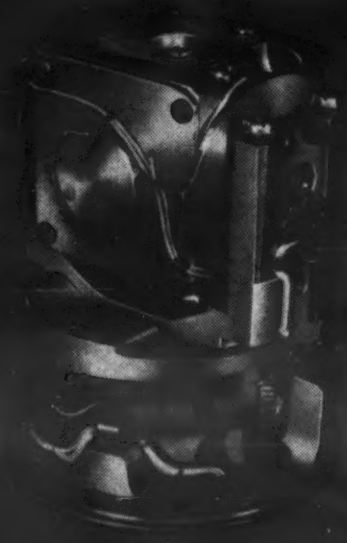
Out of advanced research, development and production at Hoffman



GYROS

FOR INERTIAL NAVIGATION AND GUIDANCE SYSTEMS



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the acid test

BY DR. WERNHER VON BRAUN

Director of Development Operations,
U. S. Army Ballistic Missile Agency

THE ACID TEST OF MEN AND nations is the measure of their courage and resourcefulness in the face of adversity and peril. Those which have survived crises have exerted the most profound influences upon mankind's destiny. Those which failed did so because they could not manage abundance and power.

Our country has faced agonizing tests more than once during its relatively short history. It emerged each time from the crucible not without scars but with greater confidence and richer maturity. America survived crises because it knew what must be done and did it without regard to consequences, with faith in its own judgment and in the resources which had to be marshalled for the common good.

Even now we are experiencing another test. Historians may record it as one of the most fateful intervals of the Twentieth Century which has certainly had more than its share of historic events. The early days of October 1957 marked a turning point in our destiny and that of other nations, large and small. An unprecedented technological achievement suddenly transformed a troubled but familiar world into one of strange and foreboding aspect. As it has, since the dawn of the Industrial Revolution, science had influenced history, and directly shaped the lives of men.

The reaction to these events has been profound. They triggered a period of self-appraisal rarely equalled in modern times. Overnight it became popular to question the bulwarks of our society: our public educational system, our industrial strength, international policy, defense strategy and forces, the capabilities of our science and technology. Even the moral fiber of our people came under searching examination. Since the evident threat was to our security, the initial preoccupation concerned modern weapons systems and means of defending against them. The Damoclean sword menacing free people consisted of a monstrous destructive force inherent in automatic delivery systems, capable of transporting thermonuclear warheads over thousands of miles, in *any* weather, across all geographic and political barriers, at velocities of such magnitude as to imply total destruction without advance warning.

The logical process of evaluating our position has been underway ever since: first, to determine if we possessed these weapons, and what means of defense could be erected. Actions have been taken by the Defense Department, fully supported by the Congress, aimed at achieving capabilities with the intermediate and intercontinental ballistic missiles at the earliest practicable date.

Perhaps it is time now, without muddying the waters further, to determine whether we have correctly assessed the total threat represented by a totalitarian regime, whose end objective is world domination.

The Soviet challenge is by no means restricted to military technology. It goes far beyond the realms of politics and armies. No longer is the task of coping with the Red menace the exclusive responsibility of generals and statesmen. The acid test involves every facet of our civilization, every part of our society: religion, economics, politics, science, technology, industry and education. Free men everywhere have been caught up in this grim competition. We who enjoy our homes, drive the family car, spend more time in leisure and less in work, who pay less attention to national affairs than to television shows, are faced with a decision. Will we do whatever is necessary to win this struggle, or will we continue in our comfortable illusion and thus court the risk of a defeat which would forever eliminate freedom, and place our children and their children under the control of an all-powerful state? What we are about to discover is whether a nation, who has rated its home run sluggers and its fullbacks above its scientists and philosophers, can meet the total competition of aggressive communism, and still preserve its way of life.

It will not be enough to perfect weapons systems which must have at least equal capability with those of a potential aggressor. Others have pointed out, that the deterrent effect of these machines of war may cancel the possibility of total conflict. It has been argued that this will turn aggression into another direction: that is, the perimeter or brush-type war, in which the huge rockets of great range and mass destructive capability would *not* be employed. Against this estimate, the Army has reshaped its striking forces and equipped them with battlefield rockets and guided missiles. The urgent need of an adequate defense posture capable of dealing with any type emergency has met a rare degree of unanimity here and abroad.

In sharp contrast, however, wide disagreement has developed over the real significance of the best-publicized exploit of communist engineering—the earth-circling satellite whose monotonous signal was intentionally audible to listeners everywhere on earth. Sceptics, who refuse to accent the possible until

United Press Telephoto

editor's note: *Your editor had the pleasure of attending a select press conference in Chicago on February 17, during the National Military - Industrial Conference and of meeting Dr. von Braun. Through the courtesy of Major General Harry Storke, Chief of Information, U.S. Army, and Dr. von Braun, the following article was obtained for the readers of SIGNAL.*

it has been demonstrated, have clouded the issue. This is a dangerous state of mind in a day, when breakthroughs occur so rapidly that obsolescence of complex weapons systems has become a primary concern.

Perhaps the launching of Explorer helped to redeem our promises, but no amount of explanation or justification can show *why we did not do it ahead of the Soviets*—and no amount of mutual backslapping that we succeeded with Explorer on the first try can hide the fact that *we have lost a round.* We cannot afford to lose much more. It was a grave error in judgment to fail to recognize the tremendous psychological impact of an omnipresent, artificial moon visible to anyone with a good pair of eyes and audible to anyone with a simple radio receiver.

Another grave error was the failure to evaluate realistically the research, development, engineering and production capabilities of a totalitarian state. This lulled us into complacency and led to an underestimate of our adversary—risky business in any competition.

Since I had the dubious privilege of living and working under a totalitarian government for many years, I should be able to discuss this topic with some degree of competence. Anyone who says that science and technology cannot flourish in a police state does himself and his country a great disservice. It is generally recognized, of course, that personal freedom of movement and thought, and a free exchange of ideas, are essential to scientific advance. From this, however, many erroneously conclude that genuine scientific work is impossible in the climate of dictatorship. Let me clear up this notion once and for all, in the interest of arriving at an honest appraisal of our situation by citing my personal experience at the Peenemuende Rocket Center in Hitler's Germany.

Neither I nor any of my associates were ever required to submit a travel itinerary in advance, whether for a short business trip or a vacation lasting several weeks. Throughout the war we had intimate, continuous contact with 36 universities and technical institutions. They performed research in support of our missile programs under contracts so broadly worded that they permitted the institutions an extremely wide latitude in implementation.

Discussions and symposia, quite similar to those conducted in this country were held frequently. Many ideas were generated in this truly liberal academic environment. True, these ideas related exclusively to our technical concerns and not to politics, but they are successfully applied even today in rocket and missile activities. As far as personal freedom of movement is concerned, as well as free exchange of ideas in the strictly scientific and technological sphere, it would thus simply be misleading to assume that things were much different than in a free country.

The heavy hand of dictatorship is rather felt in another area. In Peenemuende the security police kept dossiers on all of us, listing all the things we might have said about the regime or individuals of the upper hierarchy. Personal vices and weaknesses were catalogued in the files. But they left us alone as long as our usefulness, in their opinion, was greater than our debit account. Once they felt they could do without you, and you were in their way, they'd call for the dossier and destroy you. It was that simple.

I realize that this sounds quite awful to men who never experienced it. But the sober fact is that people, whether scientists or candle-makers, learn to live with such a situation. We don't deny ourselves week-end auto trips in spite of the National Safety Council's warnings about multiple deaths. Just so the man living under dictatorship adjusts himself to business-as-usual, whether he likes it or not, because he must, in order to survive. Something like seven hundred million people are living today under Communist rule and, in all probability, they have learned to live in the face of such possible "road accidents."

Consequently, we should disabuse ourselves of the dangerous myth that the impotent Russian scientist bends over his slide rule with a gun pointed at his head. It appears that he enjoys at least as much reward as the American scientist and that, until quite recently he had even greater latitude in his selection of resources and assistance.

We must consider, in this measure of the forces arrayed against us, the overall post war era in such areas as atomic and thermonuclear bombs, nuclear power plants, jet aircraft, guided antiaircraft missiles and long-range rockets.

When we consider their low general technological status as evidenced during the last war, plus the tremendous physical damage inflicted upon the Soviet industry by the war itself, it becomes frighteningly clear that their rate of progress greatly exceeds ours.

The real peril lies in the enormous momentum they have built-up, which certainly will yield other dramatic by-products along the way. They have long since embarked upon a dynamic program to achieve supremacy in science and technology. Their state-controlled educational system is turning out competent engineers and scientists in greater numbers than ours. It is upon this broad foundation that the Russian is waging his effort and not upon the gleanings of the brain-picking of some captive foreign scientists as many people in this country still seem to believe. Clearly we must accelerate our effort at a rate calculated to overtake and surpass the Russian advantage. And this calls for a sacrifice of an unprecedented scale.

It must be understood also that the Soviets have grasped the significance of man's imminent conquest of space and have proceeded well along the road in that direction. A current estimate of the situation would include these possibilities.

First, the Russians probably used a multistage rocket to launch their satellites which was originally designed to carry a thermonuclear warhead over intercontinental range.

Second—the same rocket configuration, with minor modifications, can place a payload of between 50 and 100 pounds on the moon.

Third—the rocket can also put up a satellite capable of military reconnaissance, equipped with a television playback feature. A few such orbital devices can keep track of the progress of all surface construction projects, ship movements and air base operations anywhere in the world. Once they achieve this, and I am convinced that it is only very few years off, "open skies" inspection for purposes of disarmament becomes academic.

Fourth—the Russians have a sound program designed to solve the question of safe return from orbital flight and related space medical problems, with the purpose of preparing for manned space travel.

I would recommend that we brace ourselves for other Soviet "firsts" in the new field of astronautics. We are behind and we cannot catch up in a day or two, since major technological projects necessarily involve lead time. It will require several years of concentrated effort to come abreast, and even longer to pull ahead.

We can waste no time commiserating over the sorry lot of the Russian worker or peasant, comparing his lack of freedom and creature comforts with our prosperity. We should also shuck off another illusion, that the Russian people will rise up to overthrow the Kremlin and thus relieve us of all our worries. Perhaps a dream of freedom exists in the Soviet Union.

Perhaps, by exposing more young people to scientific training, a search for truth will eventually react against the dictatorship. But we cannot stand around, hands in pockets, waiting for others to do what can only be accomplished by us. I am convinced that it is man's destiny to enter space and that he who controls the open spaces around us is in a position to control the earth. The only choice left to us—accept the Soviet challenge, or pay the Piper.

I certainly do not suggest that we move into space with any belligerent intentions. It would only be consistent with the fundamentals for which the United States stands, if we should propose to the United Nations the universal acceptance of the principle of the freedom of outer space—in analogy with the principle of the freedom of the seas.

But any such doctrine would be void and meaningless if we cannot back it up with a position of relative strength.

It has been said that Khruschev and Company launched their eventual downfall by the Sputnik because this country

(*Continued on page* 19)

business needs

by FREDERICK R. KAPPEL — PRESIDENT — A.T.&T. COMPANY

WE IN THE BELL SYSTEM are deeply committed to basic research. This has been essential not only to provide universal service, but to cope with inflation, reduce the effects of rising costs and increase our markets in competition with other industry.

Now perhaps in the past, we telephone people have had more need for research than others. However, I question if this is any longer true. One reason why I question it is that, today, all industry in the free world faces a new kind of competition. Soviet science is moving with tremendous mass and terrific momentum. It has stepped out into space ahead of us and it would be sheer folly not to recognize its driving will to step ahead in every other way. This is not just a matter of missiles and satellites. It is much, much more. It is a matter of markets—of leadership in trade and commerce—of the power of free industry to strengthen the public welfare and to win and keep world-wide esteem.

In the past, American industry has led the world largely because we have used existing knowledge with great ingenuity, developed new products and introduced all kinds of innovations in organizing people and machines.

But now, as I have said, we face the new and mighty competition of science and new knowledge in the hands of determined men who have flatly told us they mean to rule the world.

Can competition on this plane be successfully countered by purely industrial and productive skills alone? Not in my judgment: no more than the competition of the telephone could be met by the most artful ingenuity in the development, design and mass production of megaphones; no more than the internal combustion engine could be matched by giving the horse an extra quart of oats and putting ball bearings on the buggy.

It seems clear enough that the country as a whole is waking up to the need for science that will bring new knowledge in abundance. And we are getting more of it — much more—than we were getting twenty or even ten years ago. The part I want to touch on is only the part of industry. Many businesses today must be asking:

"Should *we* be doing more basic research? How should we go about it? And what is our risk?"

Therefore what I shall mainly do here is lay out a few facts and judgments growing from our Bell System

(*Continued on page* 14)

basic research

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AUTOMATION IN LOGISTICS

for the army of the future

by Maj. Gen.
James D. O'Connell, USA
Chief Signal Officer,
US Army

THE INEVITABLE SPEED OF ANY FUTURE WARFARE HAS influenced the planning and development of an Army logistical support system of a new order. This system is geared to meet the greatly reduced *time dimensions* of tomorrow's battlefields.

Before the Normandy invasion, nearly 2000 skilled people worked more than fourteen months to plan the embarkation schedule and subsequent logistical movements.

In another phase of planning, a dozen skilled people worked more than seven months just to correlate and plan the frequency assignments. When completed on paper, the entire plan for the Normandy landings was final. There was no room for late adjustments without repeating tedious procedures, without consuming additional time.

A serious conflict of the future will allow no such planning periods. Plans must be calculated and determined in days—not years. They must be subject to rapid changes, to flexible and quick adjustment for variable situations.

With double, triple, or a hundred times as many people as in 1944, it would be still quite impossible to plan *within modern war's time allowance* an assault comparable to "Overlord."

The solution cannot come from more people; it must come from the same advances of science that have accelerated our warfare, i.e., from automatic machines and equipment—electronic computers and data processing systems. In a word: automation.

Computers are not new to the Army. Under Army Ordnance sponsorship, a ballistics research computer was developed early in 1943. And this is considered the father of today's family of electronic computers.

This family has reached a stage of development that offers the Army, as well as industry, new and revolutionary capabilities. These are capabilities which can give us the speedy, efficient, controllable logistics support needed for new concepts of warfare. To acquire these new capabilities, the Army has been expanding its computer and data processing applications. This expansion has included lease and purchase of available commercial equipment, academic and industrial training of Army personnel, experimental use of computers and communications systems, operations research of future requirements and applications, and new courses of instruction at Army schools.

The operational result of these collective efforts is the Automatic Data Processing System (ADPS) of the Army. The interim program of ADPS leads to about 1960.

Twelve computers are in operation today; seven have been approved for installation and three await approval by the Department of Defense. Our leased commercial communications system in the United States now has switching facilities to provide an integrated and flexible system of computers through data transceivers.

In operation, a depot may put an out-of-stock requisition in machine language straight to the inventory control point for supply operations of a particular technical service. The computer then selects the closest depot to supply the items at minimum transportation cost and the shipping order goes out by transceiver to that depot.

Today, the ADPS of the Army Service serves 24 supply depots and 14 of the "brain centers" that we call national inventory control points.

To give an idea of the new capabilities at these inventory control points, an example reported from Philadelphia illustrates the great reduction in processing time that can be attained by screening 160,000 different supply items for procurement action.

In the processing time under former or *non*-ADPS procedures, the cycle starts with the computation of requirements and simultaneous collection of inventory data. It extends through subsequent operations—consolidation, forecast and review—until 180 days later when procurement was finally initiated.

Through the use of ADPS, all of these operations have been compressed *to only two days!*

This is an advance of tremendous magnitude, an advance that calls for a complete re-evaluation of other similar and related logistical operations.

Scheduled is the use of computers for automatic procurement studies and for automatic editing and subsequent preparation of procurement directives. Automatic evaluation of bid proposals has been performed for several years by the Bureau of Standards under contract to the Army Quartermaster Corps. Raw bid data is forwarded to the Bureau from the Philadelphia location of

the Army's Clothing and Textile Agency—the single manager for the Armed Services for these commodities. Computations are then made based on formula and programs developed jointly by the Army, Navy and Air Force.

Another phase of the present interim plan of ADPS for the Army is concerned with man power control and personnel management.

Since early in World War II, personnel accounting has been mechanized wherever possible throughout the Army. To effect further improvements through application of ADPS, offices of The Adjutant General now have data processing equipment at Headquarters of the Department of the Army with transceiver connections throughout the world by means of the Army's communication system. The replacement of electrical accounting machines in field units is currently under study. From the record standpoint, individual qualification and personnel data on nearly 100,000 officers of the active Army has been converted to ADPS. The Adjutant General plans next to extend the transceiver system to reporting personnel status changes to cover the 900,000 enlisted personnel of the Army.

Overseas assignments are now being made in this country prior to the time the soldier boards a ship or airplane. During early 1958 through extensions of ADPS, a soldier's ultimate overseas assignment will be made, in most cases, prior to departure from his home station in the United States. These improved assignment procedures have already made it possible to close some overseas replacement depots maintained solely to assign arriving personnel.

These are a few of the major strides being made through use of ADPS in the management of personnel, the Army's most vital resource.

In the field of transportation, an ADPS network for controlling and managing freight and personnel traffic within the United States is expected to be operational early in 1958. Another system of the Transportation Corps for embarkation centers is intended to be in operation a year later.

The Army Corps of Engineers is developing computer systems to receive, evaluate, compare and record damage to United States facilities in event of atomic attack. The engineers also have a computer system in preparation to determine the materials required for any given construction project. This system will furnish a bill of materials and the proper time phasing of proper amounts of materials. Computed data can be transmitted rapidly to all Army commands.

These examples of ADPS applications are only a few of the dividends in new capabilities that the Army is realizing and achieving under the present interim plan, leading to 1960.

Equipment to support this plan of ADPS is a major consideration. For the present, the Army is buying or leasing commercial equipment. This is an expenditure of about ten - million dollars annually for computer and processing systems.

For the future, the Army and industry are working together to develop military systems specifically designed to satisfy Army requirements. Important among these projects is one to acquire a number of mobile computing and processing units for high-echelon elements of a Field Army. By stripping a removable undercarriage, this type of unit can be transported by cargo aircraft.

To work with this mobile ADPS unit, the Army plans smaller versions for lower tactical echelons. These will be housed in standard shelters carried by cargo trucks, or mounted on a trailer or mechanical mule.

Only the research and development work associated with this tactical system can be completed during the present interim plan of ADPS for the Army, between now and 1960.

Although admittedly a short-range plan, present and continuing efforts of the Army during this period will provide valuable experience leading to a better understanding of the many new possibilities of ADPS for military application. This is a good beginning.

The Future and ADPS

For the post-1960 period, the Army has a long-range plan for ADPS. The future ADPS system will be extended from all supply depots to their national inventory control points and from these points through the responsible technical service to Headquarters, Department of the Army. Various Army posts and stations will be linked through a supporting ADPS with their present Armies of CONUS (Continental United States). The six CONUS Armies will be connected to CONARC (Headquarters, Continental Army Command), which will in turn be connected to Headquarters, Department of the Army.

The data processing systems of combat field armies are linked to overseas commands by ADPS networks, which in turn connect with Headquarters, Department of the Army.

This future program includes the development and acquisition of appropriate military ADPS equipment and facilities to handle logistics, personnel, administration, intelligence and tactical operations.

Computers within a system will be able to carry on conversations with each other. Automatic programming will permit rapid changes of existing machine routines when a command is confronted with a variable situation. Memory units will store selected data for future use and it will be updated as required. Machines will scan electronically a typewritten or printed page and reduce it to a data form for either storage or transmission.

The communication system will give high-speed transmission, automatic routing, encryption, decryption and reception of data. Clerical and typing operations will be performed automatically.

Automation today offers the Army capabilities that can revolutionize almost every phase of logistics, administration and the handling of information for tactical operations.

The great value of ADPS lies in its inherent ability to digest large volumes of information, perform programmed or preplanned operations on such data, present distilled information to decision makers, perform additional tasks as a result of these decisions and, at the same time, transmit the final decision to the action command. ADPS can receive, remember, add, subtract, multiply, divide, compare, sort, merge, process and transmit large volumes of data at electronic speeds. These many capabilities can be used to advantage by the Army of the future.

From the relatively simple requirements of such commanders as Alexander, Hannibal and Caesar to the enormously expanded logistical needs of tomorrow's military leaders, commanders have the ultimate responsibility for logistics. Availability of material means for combat is second only to the leadership of the human spirit of the men who employ such material means. To make correct decisions in time for decisive action, commanders must have a concise assembly of salient facts, derived from maximum sources. Capabilities to meet these critical demands are provided by ADPS—automatic data processing systems.

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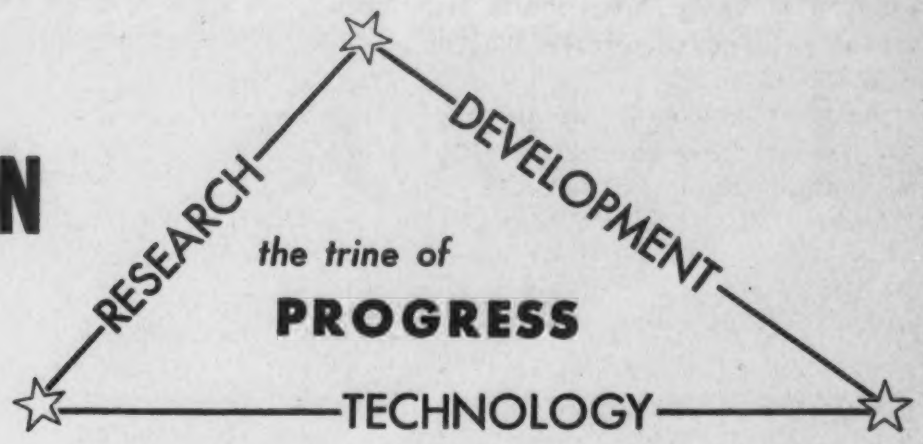

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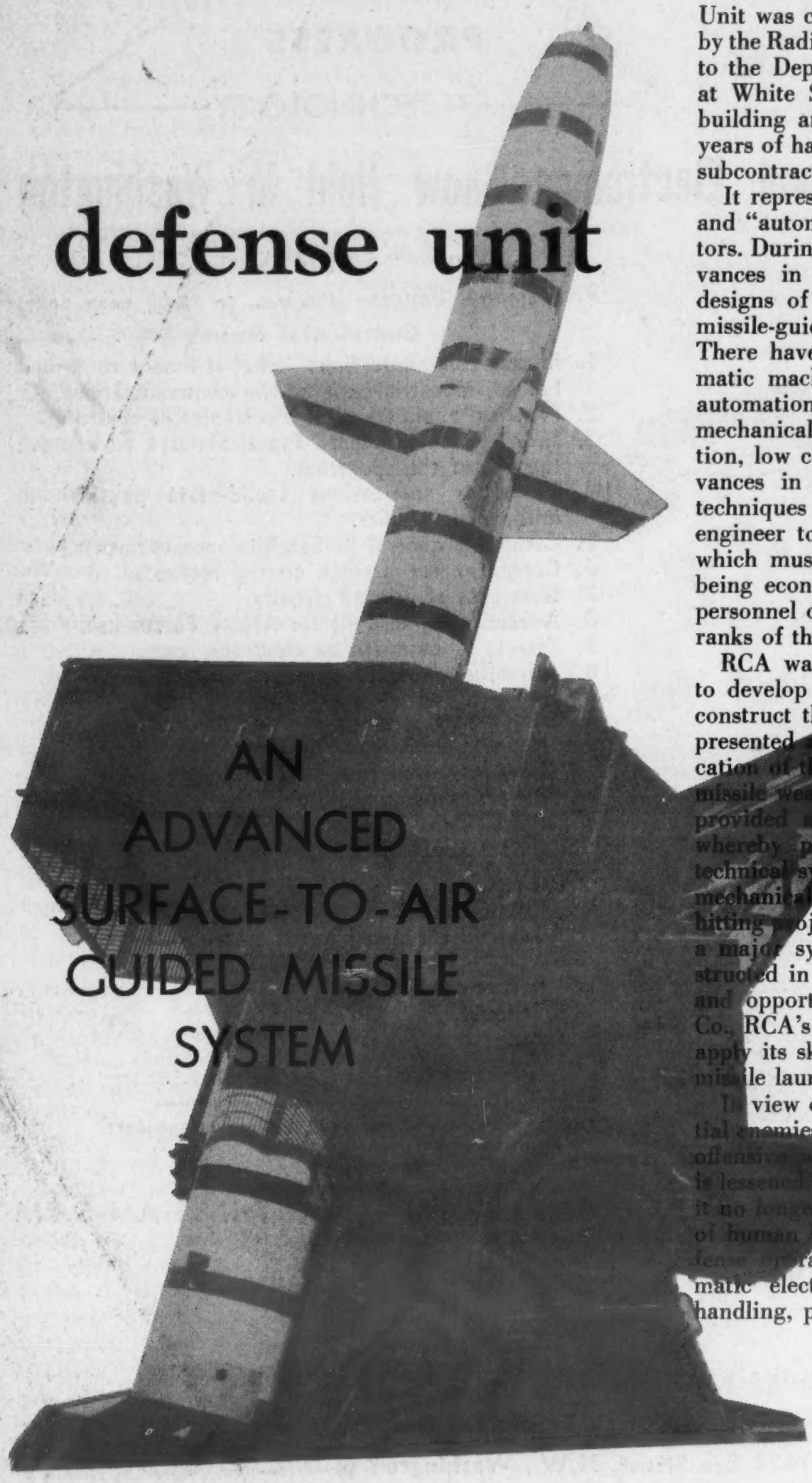
TALOS

defense unit



ON OCTOBER 15, 1957 A PROTOTYPE TALOS DEFENSE Unit was completed at the White Sands Proving Ground by the Radio Corporation of America and was turned over to the Department of Defense. The Talos Defense Unit at White Sands represents far more than the physical building and equipment resulting from two-and-one-half years of hard work by the prime contractor, RCA, and its subcontractors.

It represents the impact of the New Age of electronics and "automaticity" on military equipment and its operators. During the past decade there have been enormous advances in electronics which are reflected in improved designs of computers, data-handling equipment, radars, missile-guidance systems and tactical fire-control centers. There have been great advances in the design of automatic machinery using electronic controls, and also in automation for production of all kinds of electronic and mechanical equipment which provide for rapid production, low cost and ease of maintenance. All of these advances in electronic and automatic machinery design techniques have resulted in newer and better tools for the engineer to use in designing a modern weapon system which must be effective and highly reliable, as well as being economical and requiring a minimum number of personnel of a caliber that can be made available in the ranks of the Services.

RCA was awarded the prime contract in early 1955, to develop a Tactical Talos Land Based System and to construct the Talos Defense Unit at White Sands. This presented a challenge to RCA to demonstrate the application of the techniques of the New Age to an important missile weapon system for the defense of our country. It provided an opportunity to use the Project Approach whereby people in highly specialized skills, including technical systems engineers and exerts in electronics and mechanical engineering, could be coordinated by a hard hitting project management team to demonstrate how such a major system could be developed, designed and constructed in a minimum of time. It provided a challenge and opportunity for the American Machine & Foundry Co., RCA's close associate and principal subcontractor, to apply its skill in developing and producing an automatic missile launcher.

In view of the advances that are being made by potential enemies in developing higher speed and longer range offensive weapons, the time factor for defensive action is lessened. As the speed of airborne targets is increased, it no longer is feasible for one human brain or a group of human brains to control and carry out a tactical defense operation. It has become necessary to use automatic electronic and mechanical equipment for data handling, problem computation and actual missile firing

(*Continued on page* 59)

by Henry W. Phillips, P.E. Coordinator, Talos Projects, Missile and Surface Radar Dept., RCA

A bird in hand...

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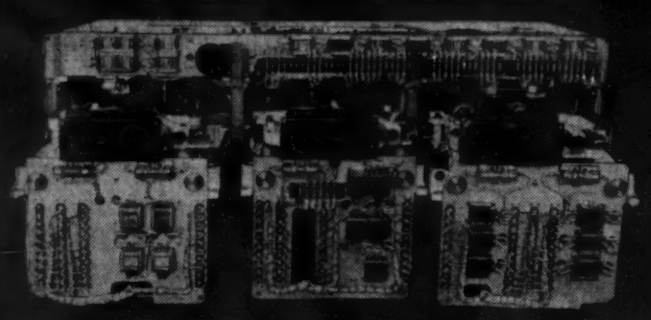

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Business Needs Basic Research

(*Continued from page 7*)

experience, and hope they will be helpful to other industries in coming to their own good answers.

Take first the question, "Is the quest for new knowledge something that really belongs in industry? Or does it belong rather in the universities and in government, with industry applying the results?"

I'll mention a few of the things our Bell scientists think about that, and reserve my own comments for later. They say: certainly basic research must be done by the universities and government, but there is great advantage — and great need — to do it within industry as well. For this there are several reasons.

The first is that the interaction of basic research with the other phases of an industry stimulates everybody. Basic researchers and development engineers working fairly close to each other in a dynamic atmosphere sharpen each other's wits. Why then should an industry choose to do without this stimulus—in fact, how can it afford to do without it?

A second reason is that the technical organization which includes a basic reseach group thereby takes out insurance against possible costly mistakes. The cost of development is far greater than the cost of research, and if a big undertaking gets off on the wrong foot the price is terribly high. Granting that any careful organization will try to guard against this—still there is no precaution quite as sound and sure as having basic research people right in the organization who are working at the deepest roots of the problem.

A third reason is that at any particular time, university scientists may not be working on the things that would do your business the most good. No matter how important their work is to them or to others, it may not be getting the new knowledge that *you* most need. A good example is the work which produced the transistor. University physicists were busy on other things. Our Bell System research opened up the field.

Well, the scientists no doubt have other reasons, but these are enough for the moment. I said I would reserve my own comment and I will make it now. As a business manager, I think these points make sense. I think this for the very practical reason that these are some of the ways in which our basic research has worked well for us. How it may be for others, only they can decide.

Now let's think about costs. Of course the cost of research is a business risk. But in any field of business, if we face new problems we must take new action. If we face new danger we must take new chances. And if the danger we face is to fall behind in knowledge, then it seems to me that taking the new risk becomes imperative.

Moreover, while we shouldn't underestimate the cost, we shouldn't overestimate it either. The fact is that a large business can do a lot through expenditures which, in relation to total volume, ought not to frighten anybody.

Someone may say, "That is all very well, but you in the Bell System have a pretty stable business and you don't have to meet the same kind of competition that other businesses do." I won't argue the point because I don't think I need to. The fact is that we work under regulation and on a much lower profit margin than most big industries. We do basic research on a thrift basis and we get back far more than we put in. Others who have more ample resources would, in my opinion, get back at least as much as we do.

Really, I think most of the hesitation about going into basic research is due to a worry that all the money may go down the drain. If you go at it the right way, however—and I'm coming to that directly—this ought not to happen. And even if it does take time to get results, when you put the cost into perspective with everything else a big business does, I don't, as I've said, see much cause for alarm. Finally, if you will accept the proposition that we surely do have a new kind of competition to meet, and must have new knowledge to meet it, then I think it ought not to be hard to show the stockholders that knowledge-building dollars are a good risk against the ultimate calamity of having commissars run your business.

Now I shall summarize some of the principles we regard as necessary to the success of basic research in the Bell System.

The first is to get the best possible people. Getting new knowledge takes a special brand of brains. And they must be well and thoroughly trained. Without this combination, nothing will be accomplished.

Second, you have to have an objective but you also have to give the brains full freedom. Maybe those two things will strike you as mutually exclusive. That hasn't been our experience. We have the broad objective of improving electrical communication. This is a perfectly clear goal. At the same time it gives the research scientist full scope for the exercise of his creative power. If you question this, I suggest you ask our scientists.

Now what is meant by freedom for the researcher?

For one thing he must be free to do what he wants to do in keeping with the broad objective, and knows he can do best. If a line of work is proposed and he says "no," take his word for it. He knows more than you do.

The scientist must also be free to plan his work in his own way. You cannot plan it for him. This means there are no schedules. There is no program by the clock or even by the calendar. After all, Isaac Newton was musing under a tree when the apple dropped on his head. The laws of gravity were not formulated on schedule.

The research scientist should also be free to publish his findings without undue delay. And you should also let him carry his work up to the point where he is sure its meaning is fully grasped by those who will go on with the development.

But it is right at this point that we bump up against the third and most difficult essential in maintaining basic research. This is to keep the researcher from becoming a developer. And this is the mistake that every research scientist will warn the business manager against. *When basic research is swallowed up by development, then basic research stops.* The only assurance of getting new knowledge is to insist that the research group stay a research group. When one piece of research is done, the results must be given to others for development and the researchers must turn to a new basic problem.

Finally, basic research today needs adequate equipment. To give just one example, in our Bell Laboratories' research, we study the basic characteristics of all manner of materials. To do this we must look at them in every possible way. This requires using many different tools, and they represent not an inconsiderable investment.

There is one thing I ought to emphasize particularly in this list of essentials. That is the disposition and temper of the manager who holds the purse strings. Of course he is itching for results. But he will have to be patient. And if you will let me speak personally for a moment, I will say just this: Whenever I get impatient, there are two thoughts I use to restrain myself. The first is that research requires no more patience on my part than it does of the man who is doing the work. And the second

thought that helps me is — thank heaven we have the research that I can be impatient about.

So much for basic principles. But I daresay some of you would have liked to stop me right after the first one—that is, that success begins with getting the best and the best-trained men. Your questions might be, for example, "How do we find them? Isn't industry already taking too many of the best scientists away from the colleges? Are not these great difficulties?"

Certainly they are difficulties. Everything about research is difficult. Nothing is easy. And I don't say for a minute that industry is going to march ahead in research if public opinion and education and industry's own support of education don't march too. Nevertheless our own scientists are convinced — and I am too—that if good men are genuinely and urgently wanted, step by step and year by year, good men will be forthcoming.

In the Bell Laboratories we spend time and money training men of promise who do not yet have the depth of training needed for research. We make arrangements with nearby universities for additional training. Moreover there is no telling how many men with the capacity for basic research are now doing development work in industry because it is in that field, rather than in the search for new knowledge, that the most opportunity today is offered.

In short, the only way to begin is to begin. And I might remind you there is more than one useful and thriving company at work today which literally was born doing research within the last few years. Their experience also throws light on another question, which is, "How long should it take, starting from scratch, to make real progress in basic research?" When I ask this of our own research people, their confident answer is that 10 years' effort will produce real accomplishment.

Now I shall close by inviting leaders in industry, and leaders also in government, to consider a single question. It is simple and short: merely this—

"What is our responsibility?"

For many years now big business has been under the necessity of justifying its existence. This is perfectly natural. Big business *does* affect the lives of everyone and it *must* continuously prove by its actions that everyone benefits. To me and I daresay to you, the evidence of the benefits is overwhelming:

—in the capacity to take on big jobs that depend on big investment;

—in the creation of new opportunities for small business;

—in the sheer ability to produce in vast quantity at low price;

—in the strength that armed ourselves and our allies in two world wars and but for which this country today might be an overseas province of, let us say, the Third Reich.

Our need to prove ourselves will never end, but I want to make this observation: It seems to me that at no time in this century has the man in the street had more reason or instinct to look hopefully and even prayerfully to big business than he has right now. He has had a thunderclap of awareness that it is big and mighty effort which has rocketed a living creature up out of the atmosphere and into the silence of space. His instinct and acknowledgement *must* be that the Soviets' kind of bigness can only be countered by another kind of bigness —and I mean our kind, which mixes bigness and freedom. So I think today we have the *potential* for a new degree of public understanding of big business, and a new public awareness that the future depends very largely on big industry and on keeping it sound and strong.

To say this, however, is only to say that our responsibility grows accordingly. And if it should be—and I am putting the question to you — if it should be that industry should fall short, not in skill or ingenuity, or organizational teamwork, or productive or marketing savvy—not in any of these things, *but in getting new* knowledge—then what degree of public understanding and approval should we expect, say, ten or twenty years from now? And is that the kind of risk we want to take?

Effects of Regulation

In our own case, as a public utility, to do the most effective research job we need the full understanding and support of the regulatory commissions. We are regulated in every state, and in some of them you would almost think the sole purpose of the regulation is to keep us from earning enough money to do a better job. In the postwar period as a whole this paucity of earning power has limited and circumscribed our effort. We have done a great deal, and I am only stating a fact when I say that this has opened up prospects for the future of communications that are bevond all calculation. Nevertheless I think we would have done more, and be somewhat further into the future than we are todav, if the conditions imposed on us had been less stringent.

Finally, let me address a few remarks to those people both in and out of public office who for reasons best known to themselves seem dedicated to the effort to harass and attack big business, and to cut it down to some other size of their own choosing.

I ask them to stop, look and listen. A few minutes ago I was saying that the cost of basic research is nothing for a big business to be scared of. However I didn't say it was free. It is in fact big enough to require big resources. For one thing, the research group needs to be large enough for its members to spark each other, and to attract the top-notch people who want to work in a scientific community that draws others of equal caliber.

So if basic research within industry is really going to grow, it is going to have to grow in big organizations. I don't mean there isn't room for it in smaller ones, especially when they are doing work for the government and the cost gets paid that way. But if industry as a whole is going to get up a full head of steam in acquiring new knowledge, the impetus has got to come from big business which has the means to pay for it.

How can those who continually attack big business expect us to accept this new kind of risk if they keep us forever preoccupied with the effort to keep ourselves whole? This is simply not the way to get on with the vital tasks that we must get on with.

So I say sincerely and urgently to those in public life: By all means, hold us in big business to our responsibilities. But give us, also, the freedom to build the strength that we need to meet them. The next generation — and the time may be shorter than that—will surely be decisive in the future of our country and the world. Let it never be said in years to come that we failed because this man had a pet theory, and that man was thinking of votes.

I hope I have made myself plain. I have said to you that we in the Bell System have found basic research essential to progress in one very important field. I have urged others in business to take note of the threat we all face and to accept whatever responsibility properly belongs with them in their fields. I have reminded members of government, finally, of their responsibility to allow us in business the freedom and the resources we need to do our job. For the stakes are high and they concern not any single group, but the welfare of the Nation and of all free people.

by CHARLES GARLAND

UNIFY THE MILITARY SERVICES?

Mr. Garland provides our readers with his views, from a purely civilian viewpoint, on the present provocative subject of military unification.

ALMOST ANY RESPONSIBLE, well-intentioned writer as young as high school level can make what appears to be a rational case of all-out unification of this Nation's military services. However, this is one of the grave dangers of that vital subject: the ease with which this controversial matter molds to the fingers of logic; the deceptive ease with which a subject involving our national defense can be over-simplified.

Quite frankly, I too would have believed much that I read and much that I heard favoring unification and myself believed in all-out unification of the services had I remained at a business desk in any one of forty-eight states, removed from the military services and the military professions.

Fortunately, it has been possible for me to move in very closely, as a civilian, to the military services of this Nation. In that proximous position, it has been possible for me also to see that even the view of the defense contract manufacturer is not one capable of providing a solid opinion on this vital subject, for, in many instances, such a manufacturer's contact with the military may be concentrated largely on a military liaison officer which hardly makes the manufacturer an expert on unification.

A long, inside look at the military establishments—Army, Navy, Air Force and Marines—provides even the most hard-headed American businessman with another, and sobering view.

As a matter of background, I have had the good fortune, also, to have been a newspaper and magazine reporter and, as such, standing outside of the inside, that is, standing on the fringes of the military establishment and there conjecturing from the outside about the inside, I, as a reporter, would have written equally as outspokenly, and equally as well-intentioned, in favor of all-out unification, as many reporters—indeed, even as many politicians—sincerely do. Frankly, I think now that I would not have known my subject, if the military were the subject, although I might have thought I knew it, just as many reporters and others, who write about unification may think they do.

That is, I am convinced that my sincere reportorial efforts, intended for reader enlightenment, instead of being enlightening, would have been misleading and in error. I am also convinced that well-meaning all-out unification people would reverse themselves, if they were given a sustained inside look, not a superficial one, and wrote from actual knowledge instead of from an outsider's surmise.

Now, the campaign for all-out unification has public, taxpayer, reader and politician appeal. All-out *unifiers*, to coin a label, can and do make all-out unification appear logical, simple of accomplishment, and beneficial. But unification's spokesmen often contend with only that which appears to them to be the gains of all-out unification, and not with that which is lost, which would be one of the *costs*, or prices, of unification. They can and do speak of gains, because the gains are in surface sight; that which is not in sight, like the iceberg, is the greater part, and security, together with the individual's lack of additional information, keep it there. I myself am convinced that the loss is greater than the gain; that the general status quo of the military establishment is capable of producing for us a stronger national defense than can be produced by all-out unification; and strength, not weakness, is the virtue of national defense.

It is admittedly difficult to reduce the case for status quo of the American military establishment to a common denominator for purposes of public dissemination and assimilation. This is most unfortunate. The modern military machine requires years of study to understand. The military establishment and the art of war are almost bewilderingly complex, but necessarily so; they cannot be over-simplified unless civilization blasts itself to rubble and begins at the bottom again with slings and rocks.

Happily, the views that follow do not deal with aspects of complexity; they do deal with a common denominator which is as American as ham and eggs, a denominator which is part of the innermost fiber of America, and one that is understood by almost every schoolchild in the United States.

Since Charles Garland's retirement from private industry in 1950, at the age of 39, he has been intimately associated with military communications at the highest Government levels, military electronics, and atomic weapons. His direct experiences involve the Army, Navy, Air Force and Marines. He has solved problems involving international projects and served Presidential Commissions on Supreme Court matters.

Before retirement, Charles Garland was widely known in motion pictures, radio, and journalism, and was a pioneer in television. He was a manufacturer and inventor of office machine accessories at the same time that his educational series, "This Amazing World!" earned for him the sobriquet, "father of mass-appeal education."

After a colorful career of broad accomplishment, he is now in public service in Washington, D. C., giving leadership and counsel to Government officials and programs in the areas of his experiences and knowledge.

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Type *3B24WA	Internal graphite anode 20 KV (epx) Diode	Type 567	Ceramic enveloped external anode high-mu pulse Triode

*Embodies UNITED ruggedized bonded Thoria filament

More and more critical as each day passes are the electronic reliability requirements for the fantastic new weapons of National Defense. The solution of a single problem is, in a sense, valueless until all others are mastered. A ceramic envelope instead of glass in an electron tube is meaningless if there remains a still weaker element — specifically a thoriated tungsten filament. To break a glass tube with a hammer blow is a pointless demonstration if a thoriated tungsten filament in a ceramic tube can be broken by a comparatively gentle tap.

UNITED ELECTRONICS leadership in the development of *criterion* vacuum sealed components is noteworthy because their reliability is *all embrasive.* **That is why other manufacturers are trying hard to copy them and become secondary sources of supply.**

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Quote by Adm. Arleigh A. Burke, USN—Chief of Naval Operations, made before a meeting in September 1957.

"We start building the spirit of *competition* and *teamwork* into your young men from the very beginning of their service careers. Service life is *competitive.* Men *compete* for promotions. Gun crews *compete* for proficiency marks. Ships *compete* for efficiency honors. In Fleet exercises we pit the world's best submariners against the best warfare teams.

"There is competition between the services, too. And there are certain rules to be observed. One is, for all services to share experience and information.

"You can be sure that each service breaks its back to improve on what it gets from the others as it adapts something for its own use. It also gives us *alternatives* from which to choose the best and discard the less promising programs early in development.

"*This is the competitive spirit. It is productive. It keeps all services on their toes*—and it is controlled by the legal machinery of the Defense Department and Joint Chiefs of Staff.

"Short of the test of actual war—*competition between and within the services* is all we have to determine how effective our weapons and tactics are.

"The *competitive spirit* keeps us from becoming complacent.

"It has been the challenge and stimulation of our own domestic *competition* that has brought our wonderful country to greatness in the world. Let's hope we preserve that spirit."

The American way of life, indeed the American's way of life, and the American standards of living, are based upon free enterprise. Another word for free enterprise is "competition." The American way of life is a competitive one, and, from competition have come America's standards.

Let us look around us and see to some extent our immersal in competition. There is competition in business. There is competition in industry. In America, schools are in competition on the athletic fields; classes and students are in competition in the Nation's classrooms. All America is a complex of competition.

During America's genesis, many nations competed for this great land; the Americans, who were by then in precarious possession, were forced to compete against others, and also against formidable Indian resistance, and wilderness, rivers, mountains, deserts, swamplands; thus, in a succession of wars before as well as after the official founding of the Nation, and against an array of inanimate enemies, Americans have competed. We Americans should never allow ourselves to be lulled into another's thinking that the removal of competition from the American way of life, or from our military institutions, shall make us stronger, or that there is a better substitute for competition for maintaining constantly increasing strengh and ceaseless improvement.

Our military services, the Army, Navy, and Air Force, are in healthy, vigorous competition, either implied, subconsciously, or officially. The personnel of each of the services have pride in the separate and distinct accomplishments and traditions of their own service. The personnel of all services enjoy keen and clean inter-service rivalry because of the separation of the services.

Of course, the sum of the separate military services is the complete American military establishment, which is dedicated to the successful defense of the Nation and in which dedication there is no division. Coupled to such dedication there must also be the desire to win, and this desire is present also among our three military services, aside from duty and loyalty to country (which are qualities many other nationals possess), because, in the American military establishment, competition is constantly before our services.

"Desire to Win"

What is "competition?" The spirit of competition is a state of mind. So are loyalty and devotion to country a state of mind. Mother-love is a state of mind. National morale is a state of mind. The fighting qualities of the United States Marines are largely derivatives of a state of mind. The desire to compete stems from a state of mind which produces the will to win, which is one of the most important qualities of a fighting force.

Unify our three competing military services and I contend that vital bases of comparison are in part removed—for how can one organization compete against itself? The very definition of the word "competition" requires the presence of two or more elements for competition to exist, for the definition is, "A contest, a contest between rivals; a match; the effort of two or more parties acting independently."

Retain service rivalry and I contend that the Nation reinvigorates its three services through competition; make the traditionally three services one and you destroy the healthy competition that does exist and which is as American as the New York City skyline, a skyline that American competition built. From competition, aside from the will to win, improvement evolves, and constant improvement is vital to the military establishment.

"Decentralized"

The classic parallel in American industry is General Motors, whose organization today reflects the concept of Alfred P. Sloan, Jr., honorary chairman of GM's board, and his "decentralized responsibility with coordinated control," — not *centralized* or totalitarian responsibility, please note, but decentralized responsibility. The result is strength and a vigorous competitive spirit within and without.

For strength to project itself outwardly, there must be strength inwardly first; and the basic requisite of a military service is *strength*, power, force. The strength to project force must first come from within. We need merely to observe and ponder the active volcano.

It may be reassuring to many to know that Mr. Sloan's organizational philosophy, as applied to General Motors, applied to the American military establishment long before Mr. Sloan was born.

But why is retention of competition among the military services crucially important? It is because the national security is involved; this means the security of every man, woman and child now living and yet unborn, and everything that Americans possess, their institutions as well as their material possessions. What is more important than those things to Americans?

The significant feature inherent in competition is the desire on the part of competitors to excel. In warfare, a nation's competition is the enemy. In war, we strive to out-produce the enemy and produce war materiel superior to his. Both of these accomplishments during war derive from competition in peacetime.

In war, we strive to out-fight our enemy, which we have learned to do, in part, during peacetime competition among ourselves in the enemy's absence.

So, in peacetime, the military maintains a competitive spirit and a will to win through competition among the three services, and that will to win is present at the start of hostilities because it was there before hostilities began!

Destroy the sources of that competitive spirit during peace time and the will to compete and the will to win

Quote by the Honorable Carl Vinson, Chairman, Committee on Armed Services, U. S. House of Representatives.

"We have heard a great deal about inter-service rivalry and inter-service *competition*. That there is inter-service *competition* is not only true, but should be encouraged. We encourage *competition in* ALL phases of American life because through *competition* we produce better products. The same thing is true in our Armed Services.

"Today, we see well-meaning, intelligent leaders of American government advocating a single military commander at the head of the Nation's Armed Forces, or a general staff organization with a single chief; or in the alternative, a sweeping reorganization of the whole Defense Department. I presume, therefore, that such critics of the present system advocate that a supreme staff be constituted with the sole responsibility of planning and no responsibility whatsoever for the execution of those plans. *I know of no better way to commit national suicide.*"

(which, again, are states of mind) must be rekindled anew during war, before they can ever be brought to bear against the enemy with effect; this is a calculated risk, and war is rife with calculated risks without adding another unnecessarily.

Will any American stand and say that competition is not good when his way of life is based upon it?

The benefits of competition have proved themselves. The results of the lack of desire to compete and win are to be seen elsewhere on this planet, and there no American would choose to go and leave behind that which he now has. Archeologists can point to mounds in the ground that represent all of that which remains of forgotten civilizations and peoples who, in their complacence, forgot that for a nation to survive, the spirit of competition must be kept alive.

Americans covet the competition that goes with their free enterprise. Abolishment of the competition that exists among the three military services could have the same effect as would abolishment of competition in our American way of life. The effects would be such, and so obvious to all, that we need not explore them.

The Nation's fighting morale, its will to win, can be legislated out of existence by whittling first on tangibles and next on intangibles, such as the present competition of the military services as one source of America's strength and fighting morale.

The country's desire to excel is inspired by competition, and that desire is a state of mind as elusive and transcendent as the aurora which comes into existence through the presence of a combination of certain conditions and vanishes when the combination which produced the phenomenon is altered.

The Nation's fighting morale is not a dollars and cents matter. At least it should *not* be. It can easily become one. The national desire to win cannot be created by an accountant's ledgers, but an accountant's ledgers can go a long way toward destroying it.

Competition of the three American military services in peacetime helps make the Nation strong and ready for the enemy in time of war. Unification? Never, sir!

Acid Test

(*Continued from page 6*)

reacted by firing up its missile and space programs.

And indeed, in more than one aspect this may be our last chance. In the first World War, as well as after Pearl Harbor, the United States had time to marshal her resources. Even in Korea and now, after Sputnik, we had time to initiate the necessary counteraction. Next time, in this world of long-range ballistic missiles and thermonuclear warheads, we may not have time. Either we will be ready at a moment's notice, or historians may conclude over the ruins of our cities that we were "weighed and found wanting."

I hope that we will not conclude that money alone will turn all the tricks—there are other factors involved which cannot be settled so easily. It would be presumptuous for me to offer "school solutions," or even to list all the things which must be considered. But there are some minimum requirements which can be identified and which demand prompt action.

Our educational offerings must come under scrutiny since it is tomorrow's generation which will have to cope with the problems developing today. If their preparation is to be compatible with the kind of world they will inhabit, our young people must be taught basic and essential knowledge at the earliest practicable age—in the elementary schools. We have got to disabuse ourselves of the idea that school is a place solely to teach boys and girls how to live together. They must understand mathematics and the physical sciences, which means more and better teachers and expanded offerings both in scope and number. Better salaries, improved professional status, and more adequate classroom and laboratory facilities are essential to obtain the kind of teachers we need who can provide the inspirational leadership to interest young minds in facts.

I do not believe the Federal Government will or should attempt to dictate such a program, but it should establish a generally recognized educational standard and it should assist in a pump-priming role in the public schools and in our colleges and universities. Education in a democracy is the concern of every citizen. The people must insist upon a redirection of emphasis and willingly accept their just measure of responsibility for execution of our educational programs. To all who ask, "what can I do to help?", my answer is to take active interest in *what* is being taught, *how* it is being taught and by *whom*.

There has been unnecessary concern about possible Federal interference in local schools. The Federal Government as well as the states have been supporting public education in greater or lesser degrees for years—all we are talking about is funneling support into more productive channels. If the Federal Government can support highway projects, why not schools?

Finally we must generate the will to supremacy. Because this is intangible, because it must come from the hearts and minds of our people, it cannot be legislated, budgeted or evoked by decree. We want no Federal propaganda machine exercising commination over the free press. We want no dictator telling us what to believe and what to do. But we must set about learning the facts and, when we have understood them, buckle down to the challenging tasks which confront us.

We must think in terms of long-range objectives, not on the time scale of next year's automobile models. We must put our trust in men assigned to carry out these programs, and not interrupt or divert them by frequent re-examinations or demands for justifications. We must supply them with the resources they require, hold them responsible for results, and leave them alone to carry out their missions. We must look for, and demand, competent and honest reporting, the hallmark of American journalism, which is sometimes lost sight of by a small segment of the press bound to carry on propaganda attacks or sales campaigns by self-serving interests.

(*Continued on page 72*)

the AIR FORCE PROCUREMENT *mission*

by Maj. Gen. W. T. Thurman, USAF, Deputy Dir., Procurement & Production, AMC

THE ROLE OF GOVERNMENT PURCHASING — AT ALL levels—municipal, county, state or Federal, must be played with an increasing proficiency and professional competence. This is true for a number of reasons. Of these, I need mention only two that are of overriding importance. The first is the permanent necessity for getting full value for each public dollar spent. The second is a closely related reason. The very high volume of Government purchasing, together with its economic, resource and social impacts, requires that responsible procurement officials merit and receive the highest possible level of public confidence in the integrity of their actions.

In discussing the specialized nature of the Air Force procurement mission, I believe that many readers will recognize old and familiar terms and principles which lie at the foundation of all procurement tasks. On the other hand, perhaps some may not have a great deal of familiarity with some of the factors and influences which are peculiar to military aeronautical procurement.

To establish a point of departure toward understanding our several types of procurement, it may be well to sketch briefly the broad outlines of our procurement organization and the general order of magnitude of our buying programs. The Air Force, in contrast to its sister services, has centralized its procurement authorities and responsibilities into a single organization—The Air Materiel Command. We do not maintain the separate bureau structure for the different classes of hardware procurement as do the Army and the Navy. There are many reasons for this, but for our purposes, this centralized arrangement gives us a fast, responsive organizational reaction to the continual changes brought about by technical advances, and simplifies the managerial job of keeping the organization aimed in the right direction. We also believe that we gain through the optimum utilization of scarce procurement skills and through our ability to standardize and make uniform our procurement criteria and procedures.

The Air Materiel Command, with Headquarters at Wright-Patterson AFB, has been delegated the procurement authorities given the Secretary of the Air Force by legislation. The Secretary retains certain review powers. The command authorities and responsibilities extend to all Air Force purchasing activities wherever located. These authorities have been distributed in the following manner. At Headquarters AMC, the policy and regulatory authorities are exercised on world-wide basis. In addition, the specific responsibilities for procuring aircraft. missiles, their major subsystems and components, together with that associated equipment which requires high engineering inputs, are performed at Dayton. The procurement responsibilities for the spares, spart parts, ground support equipment, and other less specialized hardware, have been given to our Air Materiel Areas (AMA) and Air Force Depots (AFD). These organizations have the primary responsibility of logistically supporting the operating Air Force. They are organized on a regional basis in the Continental United States. The things which are bought at Headquarters AMC and in the AMA's and Depots exclude those common and readily available items which are necessary for housekeeping, administrative and service purposes in our many air bases. For this type of procurement, which frequently can be placed in the community in which the base is located, we have delegated local procurement authorities to the base. This delegation applies to both domestic and overseas installations.

These Air Force procurement organizations together are buying approximately 10-billion dollars worth of goods and services each year. This 10-billion dollars breaks down into the following approximate amounts: For new aircraft, missiles and associated complex equipment, Headquarters AMC contracts to the extent of 6 to 7 billions of dollars; the AMA's and Depots, for logistical support purposes, place another 2 to 3-billion dollars; and the Air Force bases world-wide annually purchase about 1-billion dollars' worth of goods and services.

Naturally, each of these broad classes of procurement involves a different approach and treatment. Since the bulk of our dollars is used for the purchase of aerial weapons and the specialized equipment required to operate them, a brief discussion of this class of procurement is necessary to an understanding of our purchasing procedure.

As you all know, the technological challenge in airpower by the Soviets has required that we place top priority on the superiority of our air weapons. Moreover, this threat has demanded that these superior air weapons be in the inventory ready for operational use as early as possible. Buying of these weapons becomes an exceedingly intricate and difficult undertaking. Several very important trends in this area are significant.

First, the essential requirement for superior performance and the technological breakthroughs which have made such performance possible have resulted in exceedingly complex weapons. This complexity is making itself felt very keenly, both within the Air Force and within the several industries producing the weapons. From a physical standpoint, the tying together and integrating of the engineering for the aerodynamic, propulsion, guidance, navigation control, bombing and fire control systems has become indispensable to advanced performance. Moreover, with the extremely high speed, altitude, and range performance of these weapons, each of these engineering areas has become dependent upon the parameters of performance established for the others. For example, the aerodynamic efficiencies set the time limits and strength of the response of the flight control system. In turn, the output of the flight control system influences the performance characteristics of the navigation system, etc. An increasingly larger share of the responsibility for assuring that these several but separate arts and sciences are applied in an optimum sense to a specific weapon has been turned over to industry. We have been unable to maintain the technical and engineering skills and strengths within the Government agencies to perform the complete range of integration necessary for a successful advanced weapon system.

(*Continued on page* 22)

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Our Armed Services' urgent need for high-speed recordings prompted Burroughs Corporation—whose commercial business necessitates many types of printing devices—to develop these tools. Fact is, Burroughs Corporation has successfully undertaken many other military projects, too—often seeing them through from initial research to final installation and field service. We welcome additional projects in all areas of our proved ability, including all phases of control systems and data processing involving electronic computation.

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Within the Air Force, this factor of complexity has also had its impact. We have found in the training, operational, and logistical activities that much longer time spans are required both in the "get ready" period and in the use of the weapon in operational squadrons and wings. This has meant that within the Air Force we have had to develop a management concept which would permit the time phasing and integrating of all Air Force activities, in order to assure that we get maximum defense values out of weapons in the shortest possible time.

These two developments within industry and within the Government produced an evolution to the Air Force weapon systems concept. This concept has as its purpose the timely delivery of a new weapon system into the inventory as a complete package, ready to carry out its military mission, completely supportable, and at a proper deployment of bases, equipped with all training and skills necessary.

The weapon system approach demands that we have a single weapon system contractor who carries the basic responsibility for integrating the scientific, engineering and technical efforts and developmental products into a complete weapon package. This does not mean that he performs all of the development and production work himself, or that his contract reflects this. He is the weapon system contractor in the sense that his technical inputs to the system dominate all of the related ones and that he is the primary source for performance specifications and product characteristics for the subsystems, components and equipment going into the system. As a weapon system contractor, we are buying from him the technical management necessary to integrate and time-phase the multiple new developments and new products which will give us the required advances in weapon performance.

With this description of what has been happening to our weapons, we can now discuss what impact these events have had upon our procurement. First, the technical effort required to design and develop an advanced weapon system is becoming increasingly greater, extending over a longer period of time and requiring large outlays for production type machinery and equipment to produce the initial articles. Additionally, the testing and proving out of the advanced weapon—in order to be held within acceptable time limits—requires that orders for production quantities—as contrasted to a few experimental models—be placed while hardware is still in the creative and developmental stage. These considerations mean that basic procurement decisions must be made very early in the life cycle of a system and that the procurement dollars must be used in very substantial amounts to support the new development. Quite obviously, the making of procurement decisions at this early point in the development cycle presents a requirement for many procurement determinations which could be better made in the later phases of the program. The timing and urgencies, however, for new systems do not perimt the best possible approach to classical contracting, because procurement decisions must be reached promptly.

Among the more important specific decisions which must be made initially are the sources from which the weapon development can be procured, the sources for the development of the major subsystems and components, cost estimates for the air vehicle and for each of the major subsystems, the type and form of contracts, the extent of supportable capital outlays, tooling rates, production schedules, profit targets and ceilings, and the frequency with which these factors are to be reopened as progress is made and as we move through time.

I believe it is obvious that the only means of placing contracts for new weapons and complex equipment is through negotiation. Moreover, since we are dealing with radically new products with nothing better than educated forecasts of cost patterns, we must use the cost reimbursement type of financial settlement. Additionally, the time-spans, lead-times and levels of effort require that we assist the contractor in his financing through advance payments and progress payments.

You might well raise the question as to how we solve the problem of competition for these systems and insure the integrity of our procurements. In the matter of competition, there are a relatively limited number of sources who have built up the technical managerial and production capabilities to carry out our programs. We and the Air Research and Development Command (ARDC) are intimately familiar with these source capabilities. This knowledge has been acquired over the years.

When the requirements for a new weapon system are released, we and the Air Research and Development Command select the sources known to have the capabilities to give us the system. This is generally eight to a dozen contractors. The door is always held open for any contractor not included in this selection to establish his level of capabilities with the two Commands. The competition takes the form, among the selected sources, of technical, managerial, cost and production proposals submitted by each participant. Each of these is very carefully evaluated —against AMC and ARDC jointly developed criteria— utilizing the top talent of both Commands. The proposals are designed to yield the identification and comparative merits of the source having the strongest potential of giving us a new system on time. This method of competition has been very effective and has proved to be very satisfactory to the industry.

Our contracting for weapon systems is organized on a team concept. The buyer is supported by contract specialists, production specialists, engineers, cost analysts, pricing specialists, and programmers. Each of these specialized skills is selected on the basis of strong and deep personal background in the qualification involved. This method not only permits us to bring to bear upon the contract the total Government background for the system, but also opens up the opportunity for introducing the best and most valuable features and techniques which have proved their benefits in other programs.

The placement of procurement contracts sets in motion our managerial and administrative machinery for guiding and surveilling the contractor's performance. The focal point for our contract management is the Weapon System Project Office (WSPO) which is established exclusively for a specific weapon system. This office is jointly staffed by the Air Research and Development Command and by AMC, which permits a complete integration of the development and procurement decisions and permits uniform and consistent guidance to industry. We are thus able to keep the contractor's development efforts and his production efforts in phase both time-wise and cost-wise. In addition, the WSPO is the focal point for coordination with other commands of the Air Force, such as the using command, the training command, etc.

To aid and assist the WSPO in its management job, we have established at the contractor level contract administration specialists. These specialists are located at the plant for all major contractors and within the local community for those of lesser dollar involvement. These

(*Continued on page* 44)

Our biggest asset can't be photographed

What's inside this engineer-scientist's head? A camera won't reveal that for 30 years a trained mind has been accumulating a vast fund of knowledge on gyroscopes and has come forth with sound original thinking on inertial guidance.

No photograph can tell that another man thoroughly grasps the present state of the art in infrared technology and has creative ideas for the future.

We can't show pictorially the knowledge and reasoning ability other staff members bring to such subjects as radar, general electronics, semi-conductors, computation, mechanical design, and all the other fields of competence that go to make up a balanced research and development facility.

Nor can we show the special types of gray matter that make a first class systems engineer, a top production man, or a forward-looking executive to keep these specialists functioning smoothly as an integrated organization.

But we can tell you what these people have done in the past, what they are doing now (where military security permits), and what we believe they can do for you. Write Dept AW, Mechanical Div., General Mills, 1620 Central Ave., Minneapolis 13, Minn.

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— GOVERNMENT —

U. S. FIRST NATION TO INTRODUCE COLOR PHOTOGRAPHS ON PASSPORTS The State Department has announced that the Passport Office will accept color photographs in passports, as well as black and white photographs. Color photographs provide more accurate and attractive identification than black and white, making illegal substitution more difficult. Recent advancement in color photography has produced color pictures which meet passport requirements to withstand heat and moisture, and provide permanence.

USAF PROJECTED USE OF SINGLE-SIDEBAND MODULATION The Director of Communications-Electronics, Major General Alvin L. Pachynski, has announced the Air Force's decision to convert to single-sideband modulation for high-frequency air/ground voice use as rapidly as availability of funds, equipment, engineering and installation effort will permit. It is anticipated that this conversion will permit more reliable air/ground voice communications, particularly over long and difficult paths, and will permit a more efficient use of air/ground frequencies.

NEW GOVERNMENT POLICY ON SUBCONTRACT INSPECTIONS Under a Defense Department procurement policy change to be effective March 3, Government inspection of subcontracted supplies shall not be required at the subcontractor's plant, unless one or more of the following conditions apply: 1) test reports, inspection records, and certificates are unavailable; 2) records and reports must be verified; 3) product is shipped directly to DOD agency and Armed Services Procurement Regulations apply; 4) contract or specs require inspection at subcontractor's plant.

CONTRACTS: ARMY: Telecomputing Corp., data reduction services and test equipment, $2,446,000; Collins Radio Co., radio transmitting sets, $824,355; Hughes Aircraft Co., solid-state master amplifier, X band, $98,912; Motorola, Inc., radio stations and test program, $98,562; Stavid Engineering, Inc., research in VLF propagation, $36,643. NAVY: Westinghouse Electric Corp., propulsion equipment for small nuclear powered submarine, $1,548,679; Siegler Corp., David Bogen Co. Div., construction of static converters test models, $64,000; The Strong Electric Corp., electronic control amplifier, approximately $600,600; Librascope, Inc., subsidiary of General Precision Equipment Corp., digital fire control computers, $12,000,000; Remington Rand Division, Sperry Rand Corp., magnetic tape, Univac, $35,190. AIR FORCE: Servomechanism, Inc., manufacture of type MG-3 Central Air Data Computers, $1,041.-371; Burroughs Corp., research and development of digital computer systems and associated items for ATLAS, $20,727,000; Hoffman Electronics Corp., engineering and development of a complete electronic reconnaissance system, $11,000,000; Hycon Mfg. Co., production of supersonic aircraft reconnaissance camera (LA-11A), $1,130,000.

— INDUSTRY —

RCA DEVELOPS TRANSISTORIZED COUNTING SYSTEM A new electronic counting system, which can total simultaneously the output of forty different production, processing, or packaging operations, is being installed at the printing plant of THE DETROIT NEWS by RCA. The multiple-source counting system uses transistors throughout, a memory system, and high-speed electronic switching for lightning-fast counting up to 120,000 units a minute. The basic system can be used with a wide range of detection devices for remote counting of virtually any type of product, component or commodity.

RAYTHEON'S SILICON TRANSISTORS USED IN "EXPLORER" Cosmic ray, meteorite and temperature information now relayed to earth from the globe-girdling "EXPLORER" satellite is being gathered with the help of 2N328 transistors by the Raytheon Manufacturing Company. These transistors which are being used in the satellite's telemetering circuit are reported to have a high electrical efficiency and ability to withstand sudden surges of voltage.

MAGNETIC TAPE MACHINE THAT "REMEMBERS" A PICTURE This new magnetic tape storage device, called the Ampex Faxtape recorder, transforms a picture into magnetic impulses that can be stored indefinitely, and played back to re-create the original picture with every bit of its clarity and detail. Once on tape, the output signal may be sent to other Faxtape machines with a speed several times that of ordinary facsimile transmission. Brochure explaining functions, capabilities and typical applications of the machine is available from Ampex Corporation, 934 Charter Street, Redwood City, California.

IBM ELECTRONIC TYPING CALCULATOR The electric typewriter division of International Business Machines has introduced a new desk-size electronic computer for use in the office that combines the operations of an electric typewriter and a calculator. The computer, the IBM 632, is designed mainly for billing and invoicing operations, and is estimated to perform operations from 20% to 65% faster than the conventional machines.

"HOTSHOT TUNNEL" The fastest and hottest wind tunnel in use by private industry, with speeds up to 15,000 miles an hour and temperatures 6,000 degrees hotter than the sun's surface, is now being built at Lockheed's Missile Systems Division. Known as a "hotshot" tunnel because of the extreme speeds and temperatures, it will be used to speed development of the Navy's fleet ballistic missile POLARIS. There are only 2 other such tunnels in the free world. Both are located at the USAF Research and Development command's engineering center at Tullahoma, Tenn.

— GENERAL —

CONELRAD ATTENTION SIGNALS USED FOR EMERGENCY WEATHER WARNINGS The FCC in cooperation with the USAF and the U.S. Weather Bureau has requested broadcast stations to publicize emergency weather bulletins from CONELRAD receivers to local communities and areas. The new emergency weather warning system permits all broadcast stations (AM, FM & TV) to transmit emergency warnings of weather conditions which have an immediate threat to public life and property, during the station's regular operating hours on their regularly assigned frequencies.

FOREIGN TECHNICAL INFORMATION CENTER New measures to increase scientific knowledge through establishment of a Foreign Technical Information Center within the Department of Commerce have been announced by Secretary of Commerce Sinclair Weeks. A special appropriation of $300,000 has been requested for the new program to set up a central clearinghouse in the Commerce Department's Office of Technical Services. The Center is to collect, evaluate and distribute valuable foreign scientific and technical literature for the use of American scientists and engineers.

CONVERTIBLE RIFLESCOPE FOR HUNTERS Of interest to outdoorsmen concerned with hunting equipment is the new Command Post Riflescope which offers a split-second choice of two reticles, crosshairs or tapered post, both in one reticle. Briefly, this means complete hunting freedom . . . freedom over terrain, weather, available light with always the right reticle for the job at hand. The versatile Command Post is manufactured by D. P. Bushnell & Co., Inc., Pasadena, Calif.

"NEW DIMENSIONS IN ELECTRONICS" Application of new electronic techniques in industry, transportation and the Armed Forces is pictorially demonstrated in this motion picture available free of charge from the Advertising Department, Collins Radio Co., Cedar Rapids, Iowa. This 22-minute semi-technical, 16mm narrated film in full color documents many achievements in the broad fields of radio communication, navigation and control, depicting electronic advancements throughout the world.

CONVENTION CALENDAR:

March 24-27: The 1958 Institute of Radio Engineers' National Convention will be held in New York City. The program will include 55 technical sessions, involving some 280 papers covering 27 fields of radio and electronics, and 850 exhibitors will display items of the most advanced electronic apparatus.

April 17-18: Institute of Environmental Engineers will hold their 2nd Annual Meeting, New Yorker Hotel, New York City. Kurt R. Stehling, Vanguard Missile Project, Naval Research Laboratory, will speak at the April 18th luncheon.

April 21-25: The Society of Motion Picture and Television Engineers is having its 83rd semi-annual Convention at the Ambassador Hotel, Los Angeles. The general theme is "Films for Television." International equipment exhibitors will be included on the agenda.

April 22-24 are the dates for the 1958 Electronic Components Conference scheduled at the Ambassador Hotel in Los Angeles. "Reliable Application of Component Parts" is the theme of the conference being sponsored by PGCP, AIEE EIA and WCEMA.

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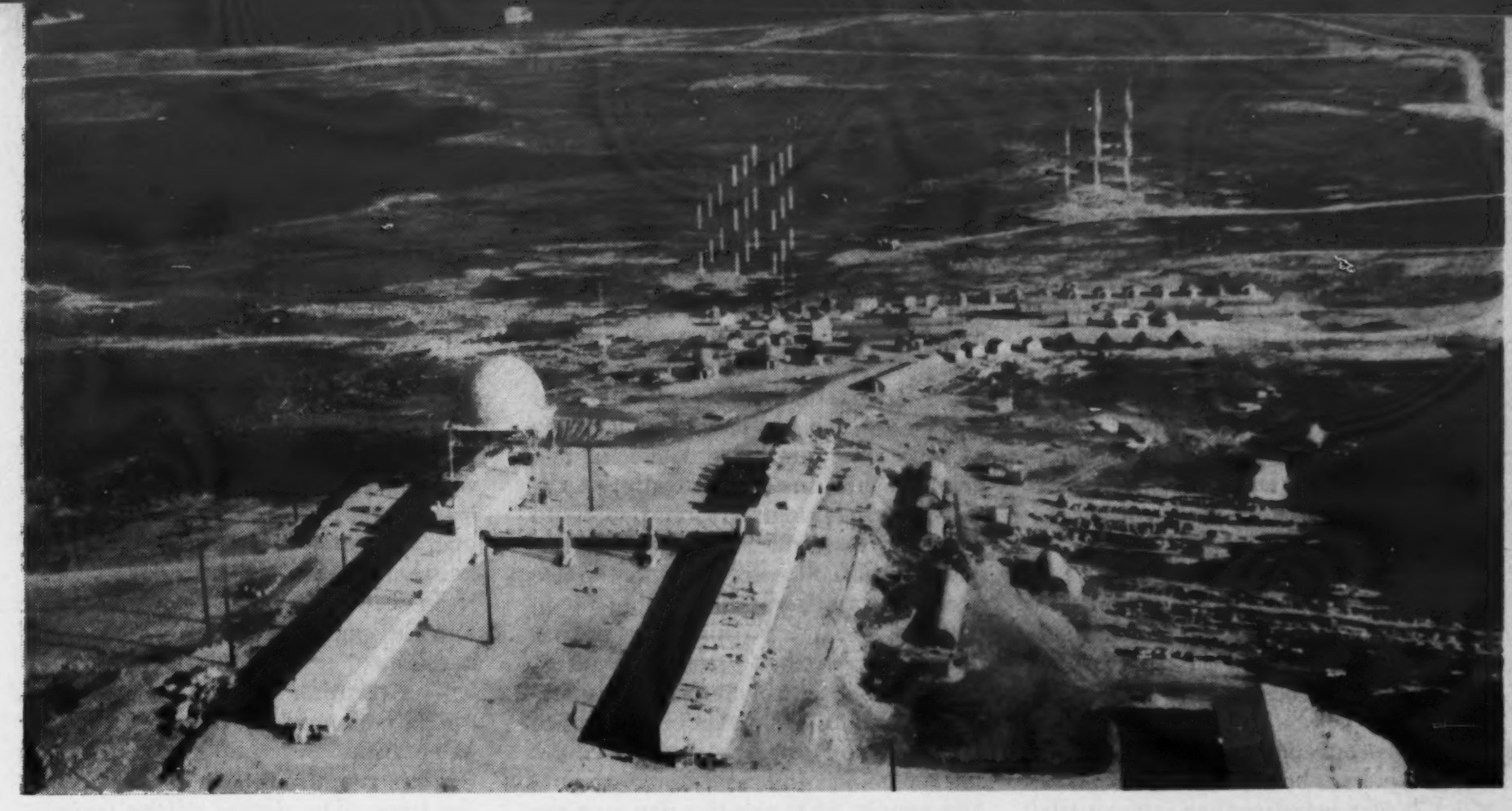

interim report on operating & maintaining the DEW line

BY MAJ. GEN. FRANCIS H. LANAHAN, USA (Ret)—PRESIDENT—FEDERAL ELECTRIC CORPORATION

THE GROWING COMPLEXITY OF weapons systems and defense systems has made solutions to the problems of National Defense increasingly difficult. The recognition that trained civilian man power and management skills drawn from United States industry could perform what had been previously considered strictly military functions has resulted in a changing concept concerning continental defense. The idea that war concerns only the military was swept away with the rubble of the bulldozed cities of World War II. The concept of the DEW Line, the construction of which has been admirably presented by Mr. A. B. Goetz, President of the Western Electric Company, in the January 1957 SIGNAL, is an expression of this changing philosophy.

Skilled civilian technical personnel are essential to supplement the Military, particularly in those support functions which augment total competence without infringement on primary missions.

The gigantic construction program which produced the DEW Line is completed. The operation and maintenance has been formally assigned to the service organization of the International Telephone & Telegraph Corporation, the Federal Electric Corporation.

Unlike the static physical barrier which was The Great Wall of China, the 3000-mile DEW Line is a dynamic electronic fence, with probing, reaching fingers north to establish the presence of flying objects approaching from that direction. Integration of the DEW Line system within the total defense system of the North American Continent results from the interconnection of the DEW Line with the Mid-Canada and Pine Tree Line and with the perimeter defenses now organized on the eastern and western boundaries.

The DEW Line consists of a series of integrated stations in constant communication with one another, as well as with the more southern detection lines, and the rearward areas to which reports of all types are sent. The electronic equipment is complex and the requirements placed on the man-machine operation are severe. The techniques of communication, as well as those of the radar and of the signaling systems. are modern and specifically designed to meet the requirements of the far North with its electronic storms and difficult propagation conditions.

The Problem Assigned

The operation and maintenance of this gigantic early warning defense line was assigned by the United States Air Force to the Federal Electric Corporation. The program required that Federal Electric select, train and send to the DEW Line an organization of technicians and mechanics backed by supervisors. They also were to build simultaneously organizations at FEC headquarters in Paramus, N. J., at two regional offices, at three staging areas and at a stateside training school in time to meet the operational date. At the same time, a supply and transportation system had to be organized which would requisition and carry the continuing tonnages of supplies and personnel as required from the United States and southern Canada to the DEW Line.

The DEW Line was designed as an austere operation, intended to perform its functions at the lowest continuing cost to the United States. Experience has indicated that in the far North it takes two men to support a third, in the sense of providing the living conditions necessary to make a long term assignment feasible. Hence, the fewer men required to do the primary mission, the fewer will be required in total to support the program.

There is practically no essential facility in the average town of the United States which is not in fact duplicated at a DEW Line station. Thus, it will be realized that the complexities of maintenance superimposed on the operations are great indeed. For example: Power at every station is generated locally. This means fuel handling and power generating facilities and the men to operate them. Water has to be provided and this is pumped and hauled from lakes deep enough not to freeze completely, or by cutting, hauling, grinding and melting ice to produce water where lakes are not available. All food must be brought in as must supplies for all equipment and person-

nel needs. Morale equipment and programs are essentials not to be overlooked. Road building, air strip clearance, maintenance and support is a continuing function if supplies are to be moved at all.

As the DEW Line is not contemplated as a short term project, it is essential that continuing and complete maintenance be performed to extend the life of every item of fixed installation. This means maximum capability on the DEW Line for such maintenance work in terms of maintenance equipment and in personnel skills.

Personnel Aspects

An enormous range of manual skills is required on the Line. The concept of "Jack-of-all-trades and Master of One" is basic. A cross-training program based on exchange of skills has been organized in a much larger measure than is normally found in the more habitable areas to the South. A diesel mechanic must be capable of doing plumbing or carpentering or welding, or for that matter, driving the caterpillar tractors for bulldozing ice and snow. To meet this need, training programs have been established as continuing functions, starting at the date of assignment and continuing for as long as a man stays on the DEW Line. Manual skills accrue from the doing, and the specialist is both teacher and pupil in the continuing on-the-job program.

The "Radician" (Radio-Radar-Electro-Mechanical Technician) is the communications and electronics operator and maintainer. To him is entrusted the primary mission of the DEW Line—detection and reporting of flying objects. More than 40 types of electronic and electro-mechanical gear are his direct responsibility.

The supply men are charged with keeping on hand at every point of need the 56,000 different line items necessary to keep all equipment in operating shape. Keeping inventories low while meeting current and anticipated needs within authorized stockage objectives are direct challenges to planning and stocking ingenuity.

The cooks and assistants prepare and supply 4400 calories per man per day in extraordinary variety and with meticulous attention to morale raising details.

Doctors and dentists patrol the Line carrying on preventive ameliorative medicine, backing the station assigned medical corpsmen trained to handle the daily problems in this area.

Directing and controlling the station operations are the station chiefs of intermediate (small), auxiliary (large) and main stations (largest and centrally located). These station groups (sectors) are under direction of the Sector Superintendent and his staff.

Two-thirds of the Line is on Canadian territory, and logic dictates that the majority of the personnel serving in the Canadian portion of the DEW Line be selected from the large and well-qualified body of Canadians. Eskimos are utilized through the cooperation of the Department of Northern Affairs of Canada which trained them to perform necessary outside plant support and maintenance.

The training schools for the technical personnel provide the basic orientation on the new electronic equipments which are in service on the Line. The design of the training program, based on the needs of the Line and its operation, includes both operational and maintenance aspects. All forty types of electronic and electro-mechanical equipments are involved and the program is of necessity an intensive one running six days per week plus "homework" for ten weeks. Only the best are graduated from the school — an additional

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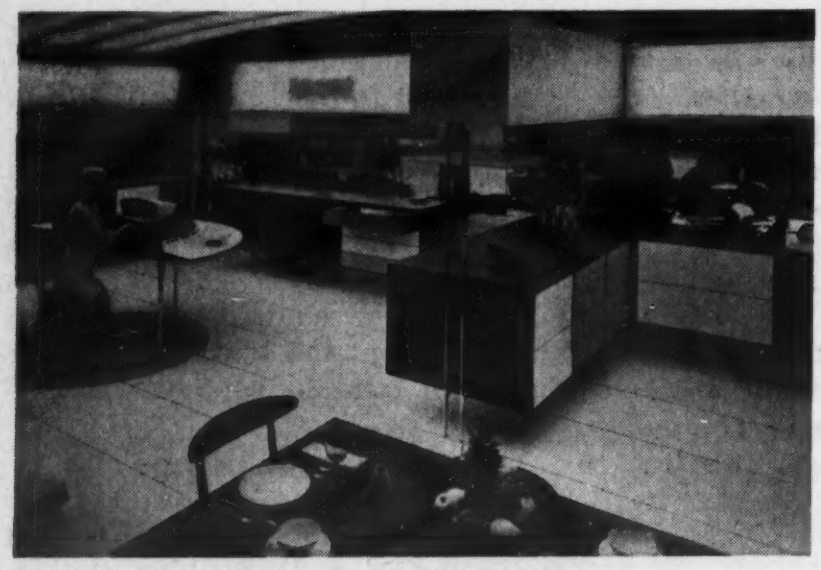
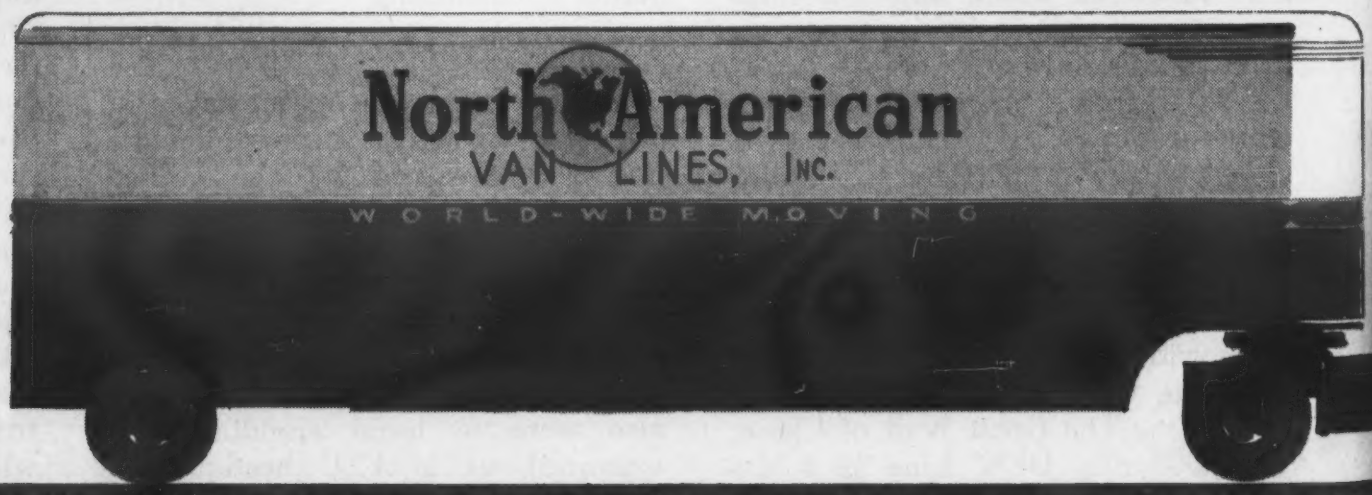


LEFT: RCA-Whirlpool Miracle Kitchen, sent city to city by North American Van, arrives okay, right on schedule.

RIGHT: North American movers load van for new Whirlpool show. Careful padding protects items for safe delivery.



DOOR-TO-DOOR DELIVERY . . . UNCRATED . . . HIGH-VALUE PRODUCTS . . . EXHIBIT DISPLAYS

"screening" operation for personnel selection. Included in the training is a course in meteorology to meet the needs of our transport system which must have reliable local weather information. Incidentally, these same weather reports contribute also to the total weather information provided both United States and Canadian Weather Services.

Selection of personnel has required the utilization of all forms of testing which have been determined as useful. Each man assigned to a Northern post is tested in the areas of competence concerned with the established job he is to do. He also takes a battery of selected tests aimed at establishing his aptitudes, leadership potential, stability, maturity, secondary interests and capacity to endure isolation. An evaluation of the personnel performance records against the tests is now under way to check their validity and to sharpen the testing tools. A fund of psychological evaluations is being accumulated which will be useful in the future of this and similar projects.

Logistics

The Logistics groups at Headquarters and Regions have the responsibility of anticipating the annual requirements down to the last detail for bulk supplies, staples and household goods, as well as spare parts for electronic and mechanical equipments. These are carried north by sea for distribution to as many stations as can be reached during the limited "summer" months when ice conditions permit ship passage. This "sealift" helps reduce the cost of supporting the Line by reducing the tonnages which have to be carried by air. The sealift, a combined operation of the U. S. Navy, Army, Air Force and the Canadian counterparts, moves the materials from our domestic shores west, via the Bering Sea, into the Arctic Ocean and east, via the Atlantic through Hudson Strait, into the Fox Basin adjacent to Baffin Island and through the Davis Straits between Baffin Island and Greenland. For a number of stations which are not capable of being reached by sea, auxiliary "re-supply" movements by caterpillar tractor train, or by air, then follow the basic sealift.

In addition to the sealift re-supply, there is the frequent re-supply of perishable foods, high value spares and replacements through the coordinated action of Air Force DEW Logistics offices and the Federal Electric supply organizations.

The supply objective is based on the philosophy of minimum inventory on the Line. This means maximum attention to consumption recording and control. The program is in its early stages and useable data is still incomplete. However, as a more comprehensive picture emerges, supply is revising unit stockage objectives for better control and better anticipation of needs.

It is obvious that in this area where dependence on air transport is almost complete, an extensive air transport system to move supplies and personnel is essential.

Two Basic Services

The DEW Line Air System consists of two basic services: The "lateral" system, which is an above-the-Arctic-Circle-trans-continental-service interconnecting the many stations from western Alaska to eastern Baffin Island, and the "vertical" service, which includes three north-south routes, Fairbanks, Alaska to the Line, Edmonton, Alberta to the Line and Montreal to the Line via Frobisher Bay plus "as required" service from Ogdon, Utah, to Edmonton and from Rome, N. Y., to Montreal. This certainly is not a small air line operation.

(Continued on next page)

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LOCATED OFFICES AND LABORATORIES

Planning this air system for lowest cost operation consistent with the requirements is an important responsibility. Flight frequency, schedules and routes are based, in part, on the needs of the supply distribution program, in part on the requirements for movement of personnel and in part, a large part, on the vagaries of the weather. Flight forecasts are subject to "change without notice." Two adjacent stations can have diametrically opposed weather conditions — one clear—the other "ceiling zero." Safety rules of the CAA for Alaska and D.O.T. (Department of Transport) for Canada are followed.

It is interesting to note that the Federal Electric Transport System is the only one covering that part of the world, East and West, North and South, and its presence is already doing much to open the far North.

Operation Analysis

Operations of such extensive magnitude in the far North are new. Little information exists which could be used to establish "bench marks" against which this operation can be measured. These must be established. An Operations Analysis Department as a staff group analyzes such diverse items as air routes and aircraft utilization, personnel turnover, telegraph traffic, cost accounting patterns, vehicle utilization and the multitude of statistical data which produce studies used as management tools for decision.

As an example, analysis of the DD 787-1 (Electronic Failure Report) produces such information as:

a) What equipment is potentially in need of redesign?
b) What station is in need of expert assistance to correct a repeating failure?
c) What Radician may need specific on job-training?
d) What component inventory level may need increase or decrease?

The three types of stations exist in sufficient numbers on the DEW Line to permit comparisons of operating proficiency, maintenance capability and costs. In addition, as similar stations are similarly equipped, troubles at any station type may be used as forecasts of troubles at the others. This permits advance planning, early distribution of "technical bulletins" about potential troubles and their cure and rapid revision of authorized stockage objectives where recurring troubles may deplete stock. Thus, the facilities for "controlled experiments" exist which permit rapid comparisons of procedures and techniques between similar stations, decreasing the time lag between trouble and "fix."

Engineering

It is recognized, of course, that starting a new field invariably results in costs which further experience and analysis will lower. The war slogan, "Is this trip necessary?" has been paraphrased into "Is this function necessary?" As an example, if a road which is snow-covered is bulldozed to permit wheeled vehicles to traverse it, it is certain that the next snow storm or wind storm will completely refill the road and in addition will probably produce enormous snowdrifts which will have to be bulldozed clean again to permit the wheeled vehicles to travel. A number of stations are assigned to the task of determining whether tracked vehicles alone or pulling sleds can travel cross-country—i.e., without roads, making snow clearance unnecessary. If successful, this program will save bulldozer fuel, maintenance time and spare parts and will deadline wheeled vehicles for 9-10 months with resulting savings in their operation and maintenance.

The Federal Electric Communications System for administrative purposes is extensive, interconnecting as it does every level of management to every station on the Line. Over 12,000 miles of duplex telegraph comprise the network which stretches from Paramus, N. J., to western Alaska, to eastern Canada and return with relay stations in Edmonton, Anchorage and Montreal. Network control rests with the Headquarters Engineering organization. Utilization of the 6-hour West-East time differential presents an opportunity to push into the "wee hours of the morning" the bulk of "TWX" traffic and thus spread the load.

Engineering is also concerned with operating and maintenance problems which affect hundreds of millions of dollars' worth of fixed and installed plant, roads, airstrips, hangars, towers and rigging, water supplies, sewage disposal and power generation.

The single responsibility which overrides all others is keeping the electronic equipment functioning so that the primary mission—detection and reporting—can be carried out.

Preventive maintenance programs are continuous and scheduled. Unscheduled "down-time" must be at a minimum and every tool is used with this objective in mind.

Reporting techniques now in operation advise all management levels within a few minutes of any difficulty which requires assistance beyond station capability. Single failures produce technical bulletins which alert all similar stations of potential troubles and recommended "fixes."

It is interesting to observe that the conditions of the far North do not lend themselves to a long and continuous tour of duty running over several years per man. This presents problems of a new sort, that is the maintenance of continuity of information and knowledge laboriously gained by each individual as he makes his own local contribution. It is essential then that a proper reporting system be installed and maintained with continuous upgrading in the quality and validity of the reports while at the same time reducing the number and frequency of them. The build up of this history and information is essential for both short and long-term planning, as well as for the continuous upgrading of the training given to new personnel assigned to the Line. Because the subject matter is so wide in type and scope, the means of storing and evaluating the reports so that they may be of immediate, as well as long term value, becomes a problem. For this reason, punched card equipments are in use while computers are on order to provide the great memory storage capacity which is essential for the correlation of the hundreds of diverse factors which upon proper evaluation may contribute to the safety and operational reliability of the job. These factors, as may be judged, apply to all sectors of management.

Numerous Visitors

An interesting side issue develops from the fact that the very existence of the DEW Line has produced a large number of visitors and would-be visitors, many of whom hope to find it convenient to carry on research and activities which have previously been impossible. However, the limited and austere design of accommodations makes the handling of such visitors extremely difficult, uncomfortable and, in most cases, impossible. Only the most essential projects can receive support on the Line and this only after thorough screening by the Air Force and Federal Electric.

The prime objective must be successful operation of the DEW Line 24 hours a day, seven days a week to provide the early warning which circumstances may require and to do this in a framework of maximum economy.

the S-Cope

STROMBERG-CARLSON

OF WHAT'S HERE AND WHAT'S COMING

from Electronics Division, Stromberg-Carlson, A Division of General Dynamics Corporation, 1467 N. Goodman Street, Rochester 3, N. Y.

GD GENERAL DYNAMICS

THE SHAPE THAT MAKES MACH 5

By way of preamble, let us describe briefly the Arnold Engineering Development Center, a key Air Force installation at Tullahoma, Tennessee. This installation is being built by U. S. Army Corps of Engineers for the U. S. Air Force. (Design architects —Sverdrup & Parcel.) Its facilities will consist of wind tunnels for testing models and propulsion systems of aircraft and missiles under conditions simulating an incredibly wide range of altitude, airspeed and temperatures.

The propulsion facilities will comprise two large "closed circuit" type wind tunnels, of the same chamber size; plus compressors driven by a single set of motors developing 216,000 HP—a lot of muscle. The transonic circuit tests engines and airframes, or models, at air velocities reaching a modest Mach 1.5. The supersonic circuit can take such units to what was once the never-never land of Mach 5.

THE NOZZLE'S THE NUB

Just upstream of the supersonic test chamber is a variable shape nozzle, the contour of which determines what air velocity is whipped up at the test section. The nozzle walls are two flexible steel plates, each 100′ long, 16′ high, and 1½-3″ thick. The walls, with 29 pairs of screw jacks on each, which are moved as desired, can mold the tunnel walls into any one of 300 different contours. Obviously, this is not the same as sinking a two-inch putt.

What's needed is the capacity to control these movements automatically or manually, keeping the tunnel operator visually apprized at all times of the wall positions.

So . . . where, you may ask, does Stromberg-Carlson come in?

We designed the electronic control system that positions the jacks and coordinates their motion with the required accuracy of ±0.008″ over a seven and one-half foot travel.

Here's the nuts-and-bolts story. The control system consists essentially of 29 "station units"—one each for the set of four jacks at each tunnel station. A memory and programmer feeds the positional commands to the various station units. An input section and control console permit the selection of the various modes of operation and actuation of the necessary safeguards.

PULSEBEAT AND HEART

The memory is a magnetic tape on which are recorded, in block form, 29 trains of pulses, each about 40,000 pulse intervals long and corresponding to one of the 29 station units.

The heart of the station unit is a digital subtractor which compares the position of the steel plate (supplied by the position sensing system) with the commanded position obtained from the memory pulse train for that station. The difference, if any, is converted to an analog voltage which is fed to the jack motors in a direction that reduces the error.

All in all, the control system consists of 26 seven-foot racks with functional elements packaged as plug-in printed card modules; all circuits are transistorized.

200 PERCENTER

In the plant of a certain world-famous photographic firm, shutter assemblies for roll film cameras are automatically assembled and 200 per cent tested at the rate of 13,000 per day.

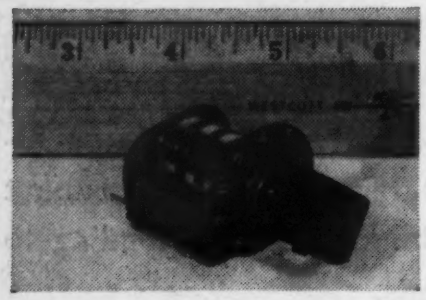
This feat of high-speed production and mathematically improbable testing is accomplished by com-

bining the camera maker's production machinery with Stromberg-Carlson test gear. Assembled shutters are automatically loaded on an endless conveyor in pallets which are positioned in successive assembly and test stations. After a shutter is tested at one station, it goes through a second identical station. Thus 200%.

Stromberg-Carlson made the two identical sets of high-speed electronic measuring equipment which are integrated with the assembly facilities. During each cycle the measuring circuits are successively activated, read out and reset by programming switches synchronized with the conveyor drive—at the rate of 30 test cycles per minute per station.

At the end of the test cycle the reject circuits are read out. Reject conditions are registered on tallying counters and stored in a memory drum synchronized with the conveyor drive. Rejected assemblies are automatically sorted in bins according to certain combinations of reject conditions. They can then be adjusted and retested.

The net result of all this: a significant reduction in the number of cameras returned from the field.



OUTGROWTH

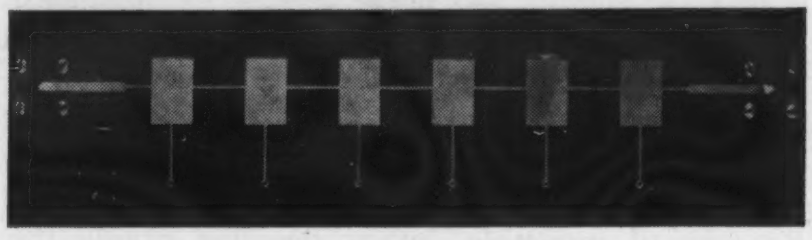
As one phase of a data link development program, ever-alert Stromberg-Carlson engineers have evolved a series of light, small, reliable rotary binary encoding switches.

They have 10 or 26 detented positions and use 6 brush pickoffs providing standard teletype code. One brush input is common and makes continuous contact with a metallic coded area on the insulated drum surface. The other pickoff brushes make or break contact with the common brush through the coded area, depending on switch position.

We've been particularly careful in the selection of "base materials" and in the fabrication techniques we use in making these switches. The brush connectors are pins which can be dip soldered into printed boards.

While the switches are basically equivalent to rotary tap switches having 5 decks, 5 poles, non-shorting 10 and 26 positions and hence should find many applications in all types of switching, their primary application is to digital encoding where small size and high performance are what you want.

OUTGROWTH AGAIN



From a microwave development program we have evolved a series of microwave circuit elements which combine light weight, small size and (as the advertising fraternity says) *best of all, low cost*—with extremely low insertion loss and good termination. Through the good offices of precision printed wiring techniques, these units have been designed and operated successfully over a wide frequency range.

Illustrated here is one example, a band-pass filter. Others include antenna radiating elements, variable tuning sections and detector mounts. In certain applications these can be used singly; in others they can be combined so that they constitute, in effect, the entire r.f. section of a microwave receiver.

We've worked out designs which show very low insertion loss and exceptional impedance over wide ranges of frequency. Components have been designed for impedance levels ranging from 20 to 80 ohms.

While they have myriad applications in microwave receiving equipment, their primary destiny is to be used where low cost and small size must be combined with high performance.

You may find yourself thirsting for more data on all these matters, just for your own information. Or you may have a problem we can help solve. We offer our engineering talents and techniques. Write to Military Marketing Department at the address on the masthead.

This is the first in a series of communications outlining unique developments, processes and techniques in electronics.

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A DIVISION OF GENERAL DYNAMICS CORPORATION

1467 N. Goodman St., Rochester 3, N. Y.

Electronic and communication products for home, industry and defense

a single sideband "radio central" to replace military wire lines

by Allen M. Creighton & Dougal B. Reeves
Motorola, Inc.—Western Military Electronics Center

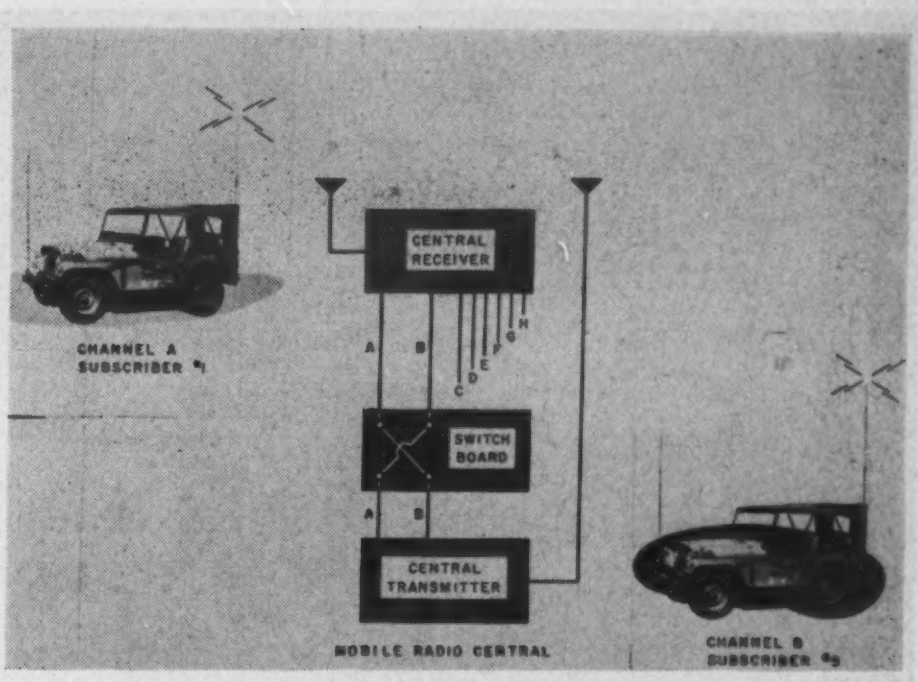


Figure 1: Radio Central System

THE COMMUNICATION REQUIREMENTS OF the present-day Military on the move are met by the use of radio networks, point-to-point radio and supplemented by a switched wire service. Atomic warfare and mass destruction weapons require greater dispersion and mobility for survival on the battlefield. Under these conditions, it has become nearly impossible to provide switched wire service. Thus, radio must supply communications almost exclusively. In the utilization of radio nets, the average volume of traffic from any one station must be very low and decreases as the number of stations increases. The waiting time to gain access to the radio net circuit is relatively high compared to other types of systems carrying an equal volume of traffic. All stations in net operation can hear all transmissions, thereby losing privacy of communications.

An alternative to the radio nets and point-to-point radio is to bring in a communication loop from each subscriber to a single location where the subscriber may be patched to communicate with other subscribers. This patching facility is called a Central. If the majority of the communication loops to the Central are via radio, it would be called a Radio Central.

Motorola has developed the equipment for a Radio Central System, using coordinated multiplex single sideband techniques with 9 voice channels. This system is designed for 95% coverage at 5 miles and 70% coverage at 10 miles. It provides a spectrum utilization factor of approximately ⅛ that of existing FM equipment.

The present Radio Central System consists of a "central station" installed in a ¾-ton weapons carrier and 16 each "subscriber stations" installed in a ¼-ton truck or jeep.

The "central station" consists of a SSB transmitter and receiver, the necessary multiplexing equipment to provide eight full-duplex voice channels and a switchboard SB-86.

Figure 1 illustrates a Radio Central System with a portion of its subscribers. When Subscriber 1 wishes to talk to Subscriber 5, he must call the operator at the central and ask for 5. The switchboard indicators and procedures for the operator are the same as when a call is processed from a wire subscriber, with one exception. A subscriber is called by depressing a button, which is located on a calling box which is attached to the switchboard.

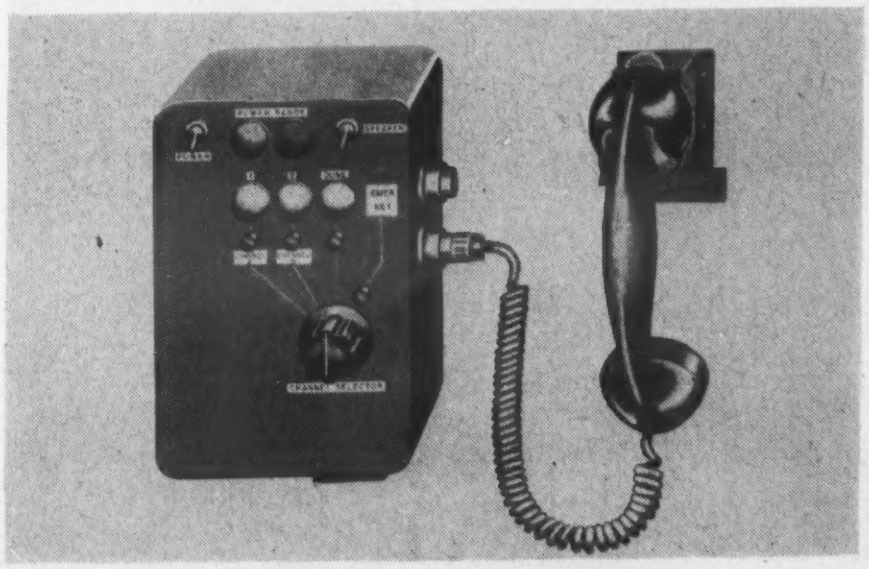


Figure 2: Subscriber's Control Head

Subscriber's Control Unit

The mobile radio subscriber uses his equipment in a manner very similar to telephone operating practices (Figure 2). He has a regular telephone type handset which is normally placed in a hang-up switch located on the dashboard of the vehicle. He is able to communicate over two regular channels shown as A and B and a conference channel marked "Conf." Each channel has its own indicator light. In event the Central station becomes inoperative, all subscribers could switch to the Emergency Net position and communicate with each other on a "push-to-talk" basis.

When receiving a call, the subscriber follows this operating procedure: He is alerted by his buzzer. He then observes the lights on his control unit. The channel light associated with the channel on which he is being called will be flashing. He then positions his channel selector switch to the indicated channel and answers the call. When he removes his handset from its hang-up switch, the channel light will change from flashing to steady.

When initiating a call, the subscriber observes his control unit and rotates his channel selector switch to a channel which has neither a flashing nor a steady light showing. He then proceeds in a manner similar to that of a wire subscriber.

Channel Assignment

The 16 subscribers share the 8 voice channels (marked A thru H) available as shown in Figure 3. Channel N is available to all subscribers for conference calls and emergency net operation. It should be pointed out that this assignment is only one of many possible arrangements for providing service to subscribers. More channels and more subscribers can be added to the system with little difficulty.

When the Radio Central was developed, certain fundamental system requirements were set up as objectives. These may be summarized as follows:

1. Provide an eight-channel multiplex system.
2. Occupy the minimum possible spectrum.
3. Provide full duplex communications.
4. Provide communication while both the central and subscribers are in motion.
5. Provide efficient use of available RF power.

It would be possible to partially fulfill some of the requirements for a Radio Central communications system by using a number of existing FM radio sets adjusted to different channel frequencies. However, the wide channel spacing required for existing equipment and self interference problems indicated that a coordinated multiplex SSB type radio system would be a much more efficient solution.

The system chosen which would best fulfill all of the above requirements was a coordinated multiplex single sideband system operating in the 150-160mc frequency range.

The 150-160mc frequency range was chosen for the following reasons:

1. The congestion within the tactical military spectrum below 100 mc indicated we should not use those frequencies.
2. Interference with other systems will be minimized due to the absence of "sky wave."
3. Atmospheric noise in the 150mc region is negligible.
4. The generation of the necessary amounts of linear single sideband power can be achieved at 150mc with practical existing tubes and circuits.

(Continued on page 36)

AFCEA's New Group Members

Lockheed Aircraft Service, Inc.

Joining the ranks of AFCEA recently is Lockheed Aircraft Service, Inc., of Ontario, California. This top-flight firm engages in the manufacture of electromechanical devices and aircraft modification.

Members of the firm who will be company representatives in AFCEA are: Duane O. Wood, vice president of operations; P. Lewis, chief engineer; C. T. Thum, manager, special devices division; Col. D. E. Wolters, USAF (Ret.), development planner; T. H. Scarborough, engineer; L. P. Wilton, engineer; J. W. Clutter, vice president of sales; J. H. Kinkade, development planner; Lowell Martin, engineer.

Acme Danneman Co., Inc.

The AFCEA proudly welcomed Acme Danneman Co., Inc., of West Englewood, New Jersey, as a new group member in February. Acme Danneman manufacturers tool and die supplies.

The members of the firm who will be company representatives in AFCEA are: Fred C. Danneman, president; Theodore C. Beck, vice president; John Wendler, vice president; Charles F. Morovec, vice president; George J. Smith, vice president; Charles O. Hoeni, treasurer; Dominick DiMarco, sales engineer; George A. LeFeure, sales engineer; George C. Fellenz, foreman; Paul J. Maikisch, foreman.

Congratulations "MIC"

The role of commerce and industry in America's national strategy was thoroughly explored during a 3-day forum at the Fourth National Military-Industrial Conference in Chicago, February 17-18-19, 1958.

Brigadier General Robert E. Wood (Ret.), Conference program chairman and former Chairman of the Board, Sears Roebuck and Co., stated that the purpose of the forum was to focus attention on the nature and purpose of national strategy, particularly in the light of current and foreseeable developments, and on a fuller understanding of the inter-relationship between civilian and military enterprise.

"Strategy is no longer confined to battlefield maneuvers, the science of logistics, or the planning boards of the general staff," General Wood commented. "It now relates to integrated management of the political, economic, educational, technological, industrial, and even ideological, resources of our entire Nation."

(*Continued on page 72*)

Is it possible to build a **MAN?**

"Theoretically, yes," said the scientist. "Or a reasonably remarkable imitation—a kind of mechanical analogue. Call it a habit machine, a mechanism operating according to the laws of the conditioned reflex."

You mean that you could actually build a mechanical mind? One that would exhibit emotions —such as love, fear, anger, loyalty?

"We're doing something like that now in advanced missile development," the scientist replied. "In a limited, highly specialized way, of course."

"Take the 'pilot' that is being developed for the big long-range missile. *He* has a wonderful memory, and can solve many complex navigational problems in a flash. *He* loves perfection, and actually becomes highly excited when *he* gets off course. *He's* a tough-skinned character, impervious to the cold at several hundred miles altitude and the incredible heat at re-entry. And *his* loyalty is heroic. *His* life is a single mission, the mission *his* whole life... and maybe ours, too. *He's* a pretty important *fellow."*

What about the complete man-made Man? What would that entail?

"A mechanism the size of the capitol in Washington, and the best scientific resources in the world. But it could be done. You see, it's only a question of how physical matter is organized. As a great biophysicist explained, 'If material is organized in a certain way, it will walk like a man. If it is organized in another way, it will fly like a missile.'"

Still, wouldn't there be something missing in the complete man-made Man—something very important?

"Yes," said the scientist. "A soul."

MARTIN

BALTIMORE · DENVER · ORLANDO

(*Continued from page* 33)

Communication Between Subscriber and Central

Figure 4 shows a block diagram of communications between one subscriber and the central station. It can be seen that, in order to achieve full duplex communications, it is necessary for the operating frequencies of the subscriber's transmitter and receiver to be different by approximately 10mc.

Separation between the antennas, when mounted on the vehicles, is about 6 feet. With proper equipment design, the transmitted power from one antenna will not degrade the performance of the receiver which is connected to the other antenna.

Single Sideband Generator

The method used in the single sideband generator is quite conventional. It basically consists of a balance modulator, a crystal controlled oscillator and a mechanical filter (Figure 5). Different oscillators and different filters will be used to generate channels A thru H and channel N.

The heart of the Single Sideband Generator is a mechanical filter. The mechanical filters used in the Radio Central equipment were developed and constructed by Motorola. The dimensions of the filter are 3½ inches x ⅝ x ½ inch.

Radio Central Frequency Spectrum

The SSB multiplex spectrum on the left of Figure 6 is transmitted by the central station. A continuous reference signal is transmitted at 156.3mc. It serves a number of purposes such as:

1. It locks all the subscribers on frequency, thus allowing the SSB intelligence to be demodulated with negligible frequency distortion.
2. It provides a carrier for selective calling and signaling tones.
3. It provides a steady signal at the subscriber's receiver, which is necessary for receiver automatic gain control and transmitter automatic output control.
4. It provides a means of operating the "out of range" light at the subscriber station.

The reference signal is spaced 78kc from the closest sideband for two major reasons: (1) so that the intermodulation products which are formed by the combination of the reference signal and the voice sidebands will fall in the gap between channel A and the reference signal; (2) to simplify the problem of separating the reference signal from the sidebands in the subscriber's receiver.

The spectrum transmitted by the subscribers is shown on the right side of Figure 6. Each channel consists of a reduced carrier single sideband signal. The carrier is adjusted so that the peak sideband power is 13db higher than the carrier power.

Proposed Frequency Assignment Radio Central System

Where a large number of Radio Central Systems are used to provide communications for many units in a military organization, it is proposed that the frequencies be interleaved and assigned as shown in Figure 7. There will undoubtedly be some restrictions concerning the geographical location of adjacent Radio Centrals. However, theoretical investigations indicate that these limitations are not too severe.

If the total frequency is divided by the number of communications channels, we find that we have a spectrum utilization figure of 7.6kc/channel. This includes guard bands. If a Radio Central System were made up of existing military FM equipment, this figure would be at least 7 or 8 times greater.

The complete details of how we generate and receive the radio frequency spectra shown in Figure 6 and Figure 7 are lengthy and complex and will not all be covered in this article. However, there are a few details in the system which might be of special interest.

Our experiments show that, if telephone like quality is to be achieved in a single sideband system, the error between the original carrier and the reinserted carrier must be held within 20 cycles per second. It can be shown that intelligence can be obtained with frequency errors up to 150cps. However, distortion becomes objectionable when the error exceeds 20 cps.

The present state of the art for stability in small mobile radio equipment allows us to achieve an oscillator drift tolerance of ±5 parts/million/month. If we look at this tolerance in terms of the operating frequencies (150mc), it could mean ±750cps at the transmitter and ±750cps at the receiver or a possible ±1500cps between the reinserted carrier and the originating carrier.

The above facts make it necessary to use some sort of automatic frequency control in a mobile SSB operating in the 150-160mc range.

Error Correction System

The Error Correction System shows the method by which we cancel the significant errors in our VHF single sideband system.

On the upper left quarter of Figure 8, let us start with f_s and assume that this is a single sideband signal which was generated by using a 450kc sub-carrier and a mechanical filter. This signal is converted up to 156mc, amplified, and transmitted from the central station's antenna. The subscriber's receiver is a form of a double super-heterodyne. However, the second conversion is rather unusual.

Let us assume that the oscillator frequency f_1 in the transmitter is intended to be the same as $f_{1'}$ in the receiver and that f_2 in the transmitter is intended to be the same as $f_{2'}$ in the receiver. However, the tolerance on the oscillators cause them to be in error by $+_1$ and $+_2$ respectively. This means that after the first conversion the first IF signals have an error of $-_2$ as shown in the diagram.

Along with the intelligence signal we send a reference signal. This is shown on the upper left quarter of the diagrams as f_r. This signal is generated by a crystal controlled oscillator. It is removed from the lowest channel of intelligence by 78kc. This reference frequency is passed through the system along with intelligence and, therefore, picks up the same frequency errors. At the input of the second mixer the reference signal and the intelligence signal are separated. If we follow the reference frequency, we can see how its error is used to cancel out the frequency error in the intelligence channel. Therefore, the locally generated carrier can be inserted with negligible frequency error. The only remaining error in the subscriber's received signal is the error in the oscillators f_r and f_s. These are relatively low frequency crystal controlled oscillators and their error is in the order of ±4 cycles/month or ±10ppm. Thus even if these errors were added directly, the error would be less than ±20cps.

Now let us follow the single sideband signal through its path between the subscriber and the central receiver. Start at the lower right quarter portion of the figure with a single sideband signal which we will call f'_s; f'_s is converted up in frequency by adding $f_1 - _2$. The second conversion up in frequency is made by adding $(f_s + 10mc) + _2$. Thus, it can be seen that the larger error in the system, which is that resulting from the 150mc oscillator frequency, is canceled out before leaving the subscriber transmitting antenna. The error remaining in the path is that which exists between the two 10mc, offset oscillators. If we use the same tolerance on these oscillators of ±5 parts per million per month, these oscillators could be 100cps in error. This possible 100cps error is not as serious as it might at first seem, because the signal transmitted from the subscriber to the central is single sideband with reduced carrier. The carrier is adjusted so that its level is approximately 13db below the peak power in the sideband. This signal is detected by the use of a special detector circuit which exalts the reduced carrier before detection.

Another interesting feature of the Radio Central is the "Automatic Output Control." One of the functions of the reference signal transmitted by the central station was to control the power output of subscriber's transmitter. Let us look, for a moment, and see why this is necessary. The system gain of the Radio Central is approximately 150db. Let us suppose subscribers number 1 and 2 are located 500 ft. from the central. The attenuation between them and the central station is approximately 60db. Subscriber number 3 is located 5 miles from the central station. The attenuation between his antenna and the central will be approximately 130db. Therefore, subscriber number 3 will be competing with signals which are 70db stronger than his own. If numbers 1 and 2 generate intermodulation products in the base receiver which are only 40db down and fall on number 3's channel, they will be 30db higher than his own signal. The above phenomenon does not make the system completely unworkable, but would mean that a certain percentage of the time when two or more subscribers were operating close to the central station, they could cause serious interference with another subscriber who is operating at 5 or more miles away. It was felt that the occurrence of this type of interference might be frequent enough to cause serious annoyance. Therefore, we have incorporated into the system a scheme which we will call Automatic Output Control, AOC. This function is as follows:

A DC voltage is derived in the subscriber's receiver from the reference frequency. The magnitude of this voltage is a function of the distance between the subscriber and the central station. This voltage is applied as gain control to the cascaded driver stages of the subscriber's transmitter. As a result, the output of the transmitter varies as a function of its distance to the central station. The output of the transmitter is reduced to 60db below full output when the subscriber is close to the central station. This automatic power control should reduce the probability of the occurrence of this type of interference to the point where it can be considered negligible.

Figure 9 shows a plot of microvolts appearing across the terminals of the central receiver as a function of microvolts appearing across the terminals of the subscriber's receiver. At the top of the figure, the microvolts are converted to miles assuming we had theoretical propagation losses over smooth earth. The solid curve is the desired characteristic and the point were the measured characteristic. The figure shows that the input to the central receiver rises to 30 microvolts and remains approximately constant even when the subscriber approaches within 200 feet of the central.

The automatic output control "AOC" is a very important part

of the system. Without this feature it is very likely that interference between subscribers would be so serious that it could not be tolerated.

Conclusions

By using a coordinated multiplex Single Sideband Radio Central, we have fulfilled the system requirements.

We have achieved a spectrum utilization factor of 7.6kc/channel, with guard bands included. This is approximately ⅛ of the spectrum that would be necessary to accommodate a Radio Central made up with existing equipment. We have demonstrated successfully the use of SSB for VHF mobile operation. By using the pilot carrier, we have developed a system which can be shifted upward in frequency without having to worry about Doppler frequency shift or oscillator stability.

An experimental Radio Central, such as the one described in this presentation, has been built and tested in the field for a period of 10 months. A system is being built consisting of 32 subscribers and two centrals. This equipment was scheduled to undergo system evaluation, at Ft. Huachuca, Arizona, in November 1957.

The development of the Radio Central System was sponsored by Signal Corps Contract DA-36-039-sc-64737.

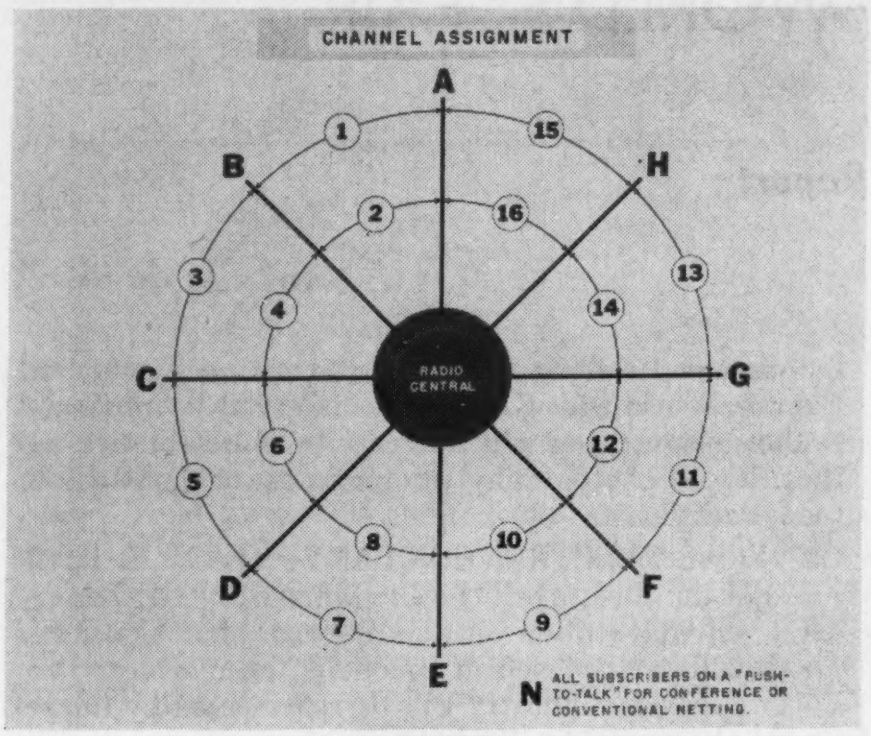


Figure 3

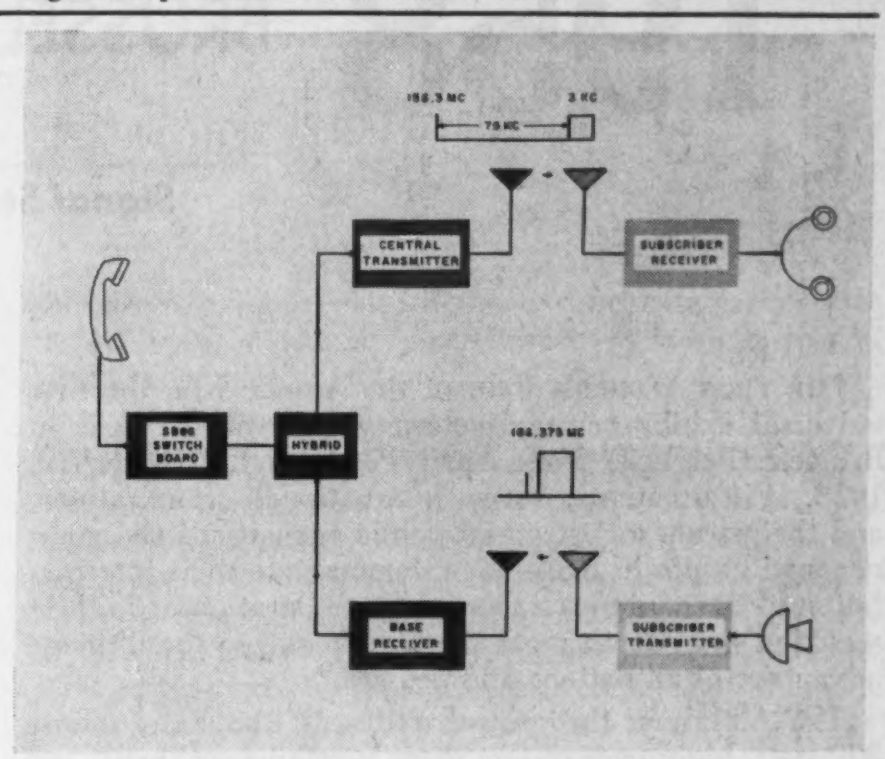
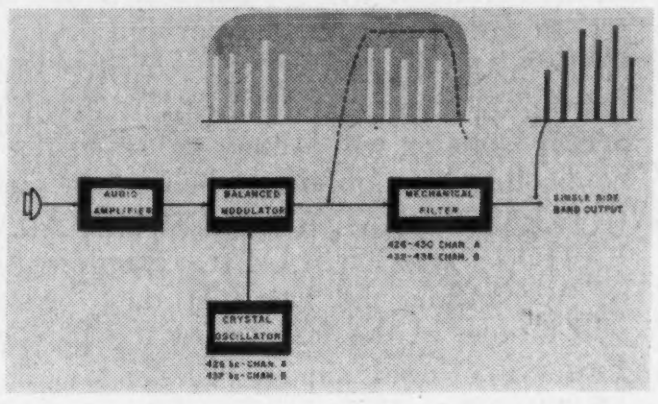


Fig. 4: Communication Between Subscriber and Central

Figure 5: Single Sideband Generator →



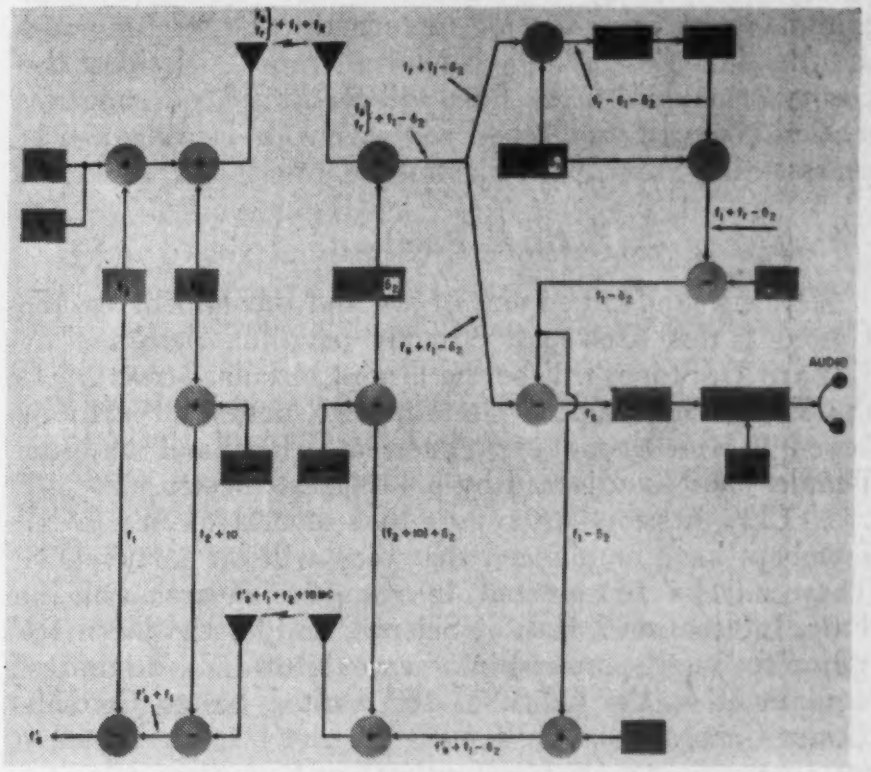


Figure 8: Error Correction System

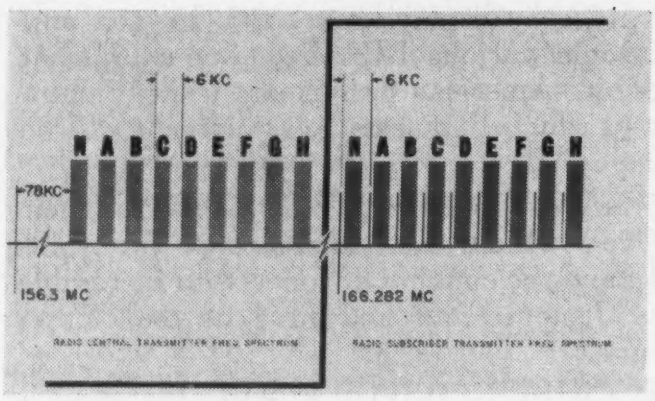


Figure 6: Radio Central Frequency Spectrum ←

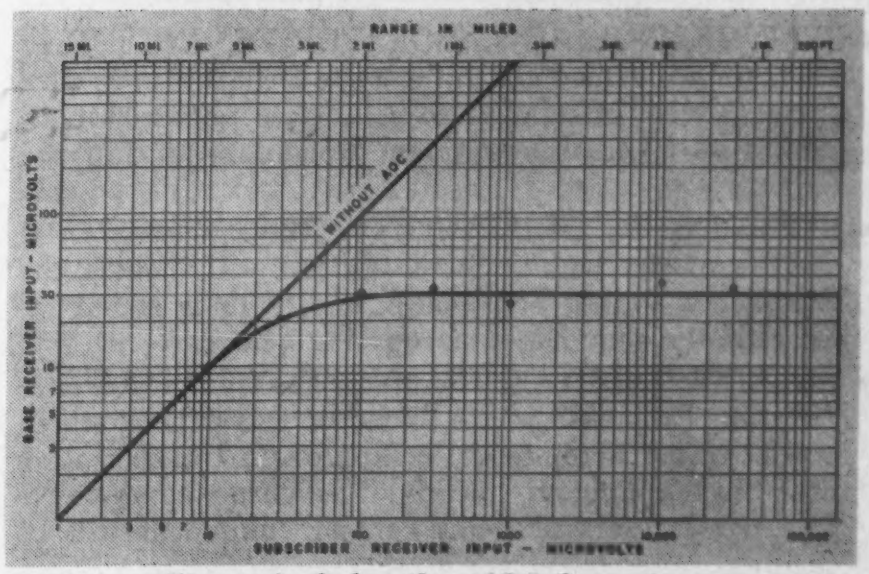
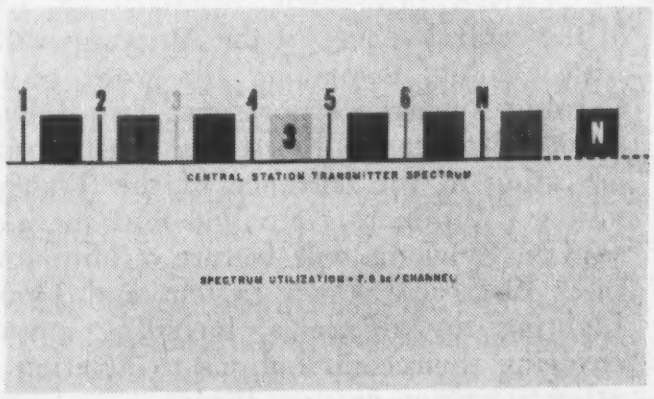


Figure 9: Subscriber AOC Operation

Figure 7: Proposed Frequency Assignment Radio Central System →



1958 BRUSSELS WORLD'S FAIR

Signal Staff Report

THE FIRST WORLD'S FAIR of the Atomic Era, the first universal exhibition in nineteen years, will be held in Brussels, Belgium, from April 17 through October 19, 1958. Fifty nations, seven international organizations, and the private industry and public agencies of six continents will unite in Brussels to demonstrate their interpretation of the conference theme: "A declaration of faith in mankind's ability to mold the atomic age to the ultimate advantage of all nations and peoples."

The Atomium, the central edifice at the Fair, towers 320 feet high over more than two-hundred halls and pavilions, covering five-hundred acres. The four main exhibit areas are: foreign, international, Belgian, and the Belgian Congo and Ruandra-Urandi. Besides the permanent exhibits, the Fair will feature plays, concerts, motion pictures and other festivals with leading artists representing participating countries.

U. S. Pavilion

Set on a landscaped site of six and one-half acres, the United States' free-span circular pavilion, designed by Edward D. Stone, will be the largest circular structure at the Fair. The pavilion contains two floors for exhibits keyed to the theme of "America—The Land and the People," and is adjoined by a 1100-seat theatre.

AFCEA is proud to report that several of our group members have announced that they will be participants. They will be represented in commercial areas of the Fair, International Hall of Science, and/or the U. S. Pavilion through sponsorship of an exhibit and/or loans of equipment to the Office of the United States Commissioner General.

AFCEA Group Member Participants

- BELL TELEPHONE LABORATORIES, INC.: They are acting as consultant to the State Department in preparing a display relating to solid-state physics for an exhibition in the International Science Section of the Fair.
- BURROUGHS CORPORATION: The Industrial Arts Section of the United States exhibit will include the Burroughs Typing Sensimatic, one of their recent releases in the commercial accounting field.
- COLLINS RADIO COMPANY: "Electronics Advance Aviation Progress" is the theme of this exhibit which will be in the Aeronautic Pavilion of the transportation area in the Belgian Section. Airborne communication/navigation and flight control equipment will be featured.
- EASTMAN KODAK COMPANY: This company is building and staffing a Photo Information Center and Exhibit. World-wide Kodak companies have contributed to the structure and will staff it with representative authorities on photography who can answer questions in many languages.
- GENERAL ELECTRIC COMPANY: The U. S. Pavilion and the theatre will be illuminated by GE Lamps. They will have three outstanding exhibits: Consumer goods will be displayed in a model kitchen center; Producer goods for industry will be represented by the recently declassified CJ805 Jet Engine; Hotpoint, Inc. electric products will include televisions, air conditioners, an electronic oven, washer and dryer.
- HOFFMAN ELECTRONICS CORPORATION: Dr. Morton B. Prince and Martin Wolf of the Semiconductor Division will present papers at the International Semiconductor Conference being held during the Fair.
- INTERNATIONAL BUSINESS MACHINES CORPORATION: The 305 RAMAC (Random Access Method of Accounting and Control) data processing system will be one of the features of the IBM exhibit at the Fair.
- MOTOROLA, INC.: A car radio, a clock radio and a phonograph are being exhibited.
- RADIO CORPORATION OF AMERICA: In the American Pavilion RCA is displaying a color TV set, and in the music room various RCA listening equipment will be on exhibit. American performers will present a live TV show in which RCA camera equipment will be used.
- RAYTHEON MANUFACTURING COMPANY: Their Radarange Oven which uses microwaves for split-second heating and the cooking of foods with incredible speed will be demonstrated and used at the "Brass Rail" concession.
- THE SOUNDSCRIBER CORPORATION: Planning is under way to exhibit the new Sound-Scriber "200-B" battery-operated portable dictating machine.
- SYLVANIA ELECTRIC PRODUCTS, INC.: One-half of the central sphere of the Atomium will be occupied with exhibits displaying the work of the Sylvania-Corning Nuclear Corporation. Two Sylvania High Intensity Strobeacon Electronic Flash units will be in operation at the entrance of the Transportation Pavilion. Within this pavilion and in the aeronautical section, Sylvania will feature a miniature display of their Electronic Flash System and Flourescent Strip Lighting for air fields, including animated exhibits covering their contributions to aviation and an operating Sylvatron unit on display.

photoprogress

by FRANK SMITH
PHOTO EDITOR
SIGNAL

"Eyes in The Sky"

THE U. S. ARMY SIGNAL CORPS HAS ANNOUNCED development of the "Night-Hawk," a new life and money saving photo-reconnaissance system designed to give commanders low-level aerial photographs of enemy territory during the hours of darkness.

The Night-Hawk, or night drone patrol, combines a seeing eye in the form of a new lightweight, rugged camera and an automatic flare ejector with the fast-flying ability of a small radio-controlled RP-71 pilotless aircraft.

The Army's new night surveillance system will answer a major problem of front line tactical commanders to observe the enemy's positions and movements "over the next hill" or screened from view.

Seeing eye of the Night-Hawk is the highly compact, 15-pound KA-28 camera which slips easily into the drone fuselage. The camera has no shutter in the ordinary sense. The lens is automatically uncovered when photography starts and covered after a series of pictures have been taken. The film records a picture as each photoflash ignites after being fired from the ejector. Synchronized with the speed of the drone, the moving film and camera have image motion compensation, or IMC, to provide clarity of exposures, avoiding motion blur.

The camera was developed by the U. S. Army Signal Engineering Laboratories and was built by Fairchild Camera and Instrument Corp., Syosset, N. Y.

Fairchild Camera and Instrument Corp., Syosset, N. Y., has taken the wraps off its newest photographic reconnaissance system, designed specifically for the Convair R.B.-58 Hustler, world's first supersonic bomber.

The unique system, contained in a detachable pod which can be interchanged for bombing or electronic counter-measure pod systems, has a number of new features. All of the cameras in the system are new designs, built to function at supersonic speeds at both extremely high and low altitudes.

For the first time, closed circuit TV is employed in a photo-reconnaissance system. This provides the photo-navigator with an unobstructed view of the forward terrain in sufficient detail to permit him to identify significant landmarks and targets.

Three new types of aerial cameras were designed for the system with negative sizes of 9 x 18 inches, 9 x 9 inches and 2¼ x 2¼ inches and designated the KA-27, KA-25 and KA-26, respectively.

Image motion compensation (IMC) is achieved in the system by matching or synchronizing the film velocity with image speed at the time of exposure to eliminate blur.

The cameras can be assembled in the pod in two configurations, the Hi-Low altitude or the Low altitude, depending upon mission and flight plan. The system includes a ground-based system of automatic, high-speed film processors, paper processors and printers for all sizes of film used in the system. It also includes a special 35mm radar film viewer-printer.

Microphotography and Photomicrography

Purely by coincidence perhaps, your writer recently received two books, or rather a book and a booklet, covering photography at two extremes—microphotography, which is the making of microscopically small photographs, and photomicrography, which is the making of enlarged photographs of a microscopic object. Although the two terms are often incorrectly used to denote one or the other, the distinction should be clearly noted. Perhaps the easiest way to fix this distinction in one's mind is to remember that a microphotograph is always made by optical reduction, such as in microfilming and that a photomicrograph is always made through a microscope. With the correct definitions in mind, your writer will proceed with a thumb-nail review, so to speak, of the book and booklet covering them.

The first book, entitled *Microphotography*, by G. W. W. Stevens, is a beautifully presented volume of 326 pages and is amply illustrated with some 84 line and half-tone cuts.

Microphotography is divided into 13 chapters and three appendixes. A name and author index and a subject index completes the volume. As is indicated in the title, *Microphotography* is a book about photography at extreme resolution.

The 13 chapter titles are as follows: 1. The Study of Microphotography; 2. Introduction to Microphotographic Technique; 3. The Sensitive Material; 4. The Processing of Micrographs; 5. The Objective; 6. Establishment and Maintenance of Focus; 7. The Workroom, Camera and Optical Bench; 8. The Original and Its Illumination; 9. Micrographic Technique; 10. Anomalous Image Formation; 11. Graticules (Reticles); 12. Document Microphotography, and 13. Microphotography.

As stated in the preface, the author has collected those parts of the published information which seemed most important for the practice and application of microphotography, supplemented it by his own observations and experiments in this field and has presented it in an easily understandable way in the present volume. Beginning with the scope of microphotography, its origins, techniques, sensitive materials, and on through processing, lenses, cameras, illumination and image formation to applications such as graticules and document microphotography, Stevens presents his subject in such a scholarly and authoritative manner that the volume is a "must" for those who are interested in this field. Published in 1957 by John Wiley and Sons, 440 Fourth Avenue, New York 16, N. Y., the book is priced at $8.50.

Photography Through the Microscope" is a 72-page Kodak Data Book on photomicrography which has been revised to include new specialized techniques, bringing it up to date on current materials, equipment and practices. New specialized techniques including ultraviolet, infrared, phase and electron photomicrography are briefly described. The book, which is well illustrated, includes descriptions of equipment and conventional techniques for making photomicrographs with a compound microscope at low, medium and high magnifications.

The revision includes a series of data sheets which have been placed together at the back of the book for handy references.

Other chapters deal with equipment, films and plates, subject illumination, filters, professional techniques, simple techniques and exposure determination.

Photography Through the Microscope is available for 75¢ through photographic dealers.

Polaroid Color Film

Perhaps the most exciting announcement—according to recent press reports—is the report that Polaroid Corp. of Cambridge, Mass., has succeeded in making direct full-color prints in one minute using the Polaroid Land picture-in-a-minute camera. Although the process has proved to be feasible, it is emphasized that basic techniques must be explored before manufacture of the film can be planned and that it cannot be predicted at this time when the film will be available to users. Generally speaking, as with most new photographic color processes, a considerable period, sometimes years, is required to perfect the process.

Present plan of the company is to adapt the new color film to work with the current Polaroid cameras, so that direct full-color pictures may be made much in the same fashion as is presently done with the present black-and-white Polaroid film. It is said that the Eastman Kodak Co. has been granted a contract by Polaroid to study production techniques and develop methods for manufacture of materials for the new films.

Super Anscochrome Daylight Type Color Film for Motion Pictures

According to an announcement by Ansco, Binghamton, N. Y., their new Super Anscochrome Daylight Type Color film is now available in 16mm, 35mm and 70mm sizes. This new positive film, which is stated to be ten times faster than traditional color films, has an official Exposure Index of 100 with normal processing. The film is especially suited for the rapidly expanding specialized industrial field, brought about by the rocket and missile age. The film, in 70mm width, will make it possible to utilize fully the modern cameras used in supersonic missile tracking as well as sequence type photography.

The film combines high speed, good latitude, clean highlights and superior shadow area penetration which are so desirable for high-speed motion analysis, stress studies, data recording and available light cinema-reportage and other uses in the industrial, scientific, military, medical, engineering, and other professional fields.

Color Photography by Matchlight

Ansco of Binghamton, N. Y., has announced the availability of their new film, Super Anscochrome Tungsten Type, with an official exposure index of 100 with normal processing. Claimed to be the world's fastest indoor color film, it will actually make color pictures by the light of a single match. For those who would like to try this for themselves, the company recommends that the light from a single match should be held from 6 to 10 inches from the subject with an exposure of 1/5th second at f/2. The new film produces accurate color reproduction, and possesses wide latitude and versatility.

Although designed for tungsten illumination, the film gives excellent results in daylight with an 85B filter. Initially, Super Anscochrome Tungsten type will be supplied in 20 exposure 35mm size only. 120 roll film will be available later.

Synchronizing High-Speed Prism Cameras

From the Naval Research Laboratory, Washington, D. C., comes a report of the development of a successful system for synchronizing high-speed prism cameras in which the picture frames are counted electronically, and the event to be photographed is triggered after a preset count has been reached, independent of the time required to reach this count on the film.

As is well known, development of high-speed motion picture cameras with framing speeds as high as 17,000 per second has made possible recording of transient phenomena of less than one-milli-second duration. Synchronization of such phenomena with the very high framing speed now possible is not easily accomplished with conventional timing apparatus. Since the number of frames passed prior to the point of maximum framing speed is as exact as the total film length, counting the frames independently of the camera speed is suggested as a criterion for effecting the coincidence of an event with the maximum framing speed. The timewise uncertainty in such a system would then be reckoned in terms of the interval between initiation of an event and the time at which it is to be photographed. This interval, in general, will be only a fraction of the total running time of the camera.

The components of the system include a variable reluctance probe, preamplifier, electronic counters and relays for power control and are commercially available at a total cost comparable to conventional timing apparatus.

For those interested in a more detailed account of the system, it is suggested that the full report, entitled "Synchronization of a High-Speed Prism Camera by Frame Counting Technique," by D. A. Hall and S. O. Bailey, published in the *Report of NRL Progress* for Sept. 1957, be obtained.

Double-Flash Light Source

A sub-microsecond flash unit for silhouette photography, non-elaborate but precise, has been developed by Edgerton, Germeshausen and Grier, Inc., 160 Brookline Ave., Boston 15, Mass., for the measurement of the velocities and patterns of air shock waves produced by explosives or the speeds of objects moving up to 8,000 feet per second. Known as the Type 2307 Double-Flash Light Source, the instrument is an accurately timed point source of light which flashes twice at accurately timed intervals ranging from 0 to 100 microseconds, resulting in two superimposed exposures, silhouette or shadow, on the same film. The distance traveled on the photograph when divided by the known time elapsed between exposures, as present on the instrument, is the average velocity.

A dial adjusting the time interval between exposures is directly readable in microseconds with an accuracy of ½ microsecond. Each flash has a duration of ⅓ microsecond, and the initial flash can be triggered photoelectrically, electrically, manually or by sound waves.

The extremely short exposure time is obtained from the discharge of a small capacitor (0.005 mfd) charged to 7,000 volts into a confined spark gap. An 8" x 8" plastic

(*Continued on page* 42)

Whenever scientific work calls for the recording of images from instruments special characteristics are called for in recording films. That is why Ansco produced Ansco Recording Film FPC 42-1. Here is a blue sensitive emulsion resolving 100 lines per millimeter that may be rapid processed at high temperatures in *seconds!*

This makes it ideal for airborne recording of radarscope line—scan images as well as PPI, flying spot and transient traces of all types. Its blue sensitivity makes it the obvious choice for recording emissions of the phosphors including P-5, P-11, P-16, P-4, P-7, P-14, P-15, and P-22.

Ansco Recording Film FPC 42-1 may be processed as a negative, or a positive.

In spite of low tungsten exposure rating, sensitivity to the emitting phosphors is comparable to that of a panchromatic emulsion having a daylight rating of 80! This is because only a small part of the sensitivity of a panchromatic emulsion is used while all the sensitivity of FPC 42-1 is used for this work. Ansco, Binghamton, New York. A Division of General Aniline & Film Corporation.

TECHNICAL DATA

Spectral Characteristics. Peak sensitivity 3700 Angstrom units with conventional glass optics.

Resolving Power. 100 lines /mm.

Exposure index. Daylight 20, Tungsten 6.

Processing. Safelight; Series I with 25 watt lamp, Ansco Permadol 8 minutes at 68 deg. F, Ansco Liquidol X-ray Developer at 120 deg. F (with 1cc Tergitil Penetrant per litre solution) developed for 8 seconds.

Ansco

Recording Film F.P.C. 42-1

Fresnel type field lens is provided at one end of the unit for silhouette photography. The plastic lens can be removed and any other optical element substituted for collecting the light, and the equipment can readily be adapted for single exposure photography by cutting out either flash.

The entire electronic control equipment and the optical system are contained in a metal case 12" high x 10" x 20" long, and weighs 45 lbs. A microphone, a photo-tube and a manual switch and cable are included for triggering the initial flash as desired.

This new instrument fills a need for a portable, easily used light source with particular application to ballistic and explosive research in small-scale laboratory experiments where a short exposure is essential.

Eyetron, A System of Seeing by Means of Microwaves

Though not directly related to photography, your writer was much intrigued by a recent announcement of the Diamond Antenna and Microwave Corp. of Wakefield, Mass., concerning their new revolutionary device called Eyetron which "sees" by means of microwaves. Since the device is claimed to "see," it is not unreasonable to assume that here we may have another means of photography or, at least, a method of "illuminating" scenes by microwaves so that photographs may be made by conventional or unconventional methods. Actually, in the Eyetron system, radio waves are converted into visible light and allow the eye to see through elements of fog, rain, snow or similar media.

The company states that Eyetron is not radar nor is its purpose to replace radar. Eyetron produces a full picture of objects and scenes instantaneously and continuously, corresponding in every detail to that which would be seen by the human eye under ideal conditions.

This radio image translator operates by separating incoming rays according to their direction of arrival, channeling these rays into exact regions where they are sensed and amplified, and then caused to produce light in corresponding regions of a viewing screen. Through variations in the electronic circuitry, special effects and applications can be achieved which are impossible with optical systems. Essentially, these include change of picture contrast, suppression of background, inversion of the image, and controlled distortion (reduction or expansion) of the image.

Photographic Studies of Ultra-High-Speed Phenomena

A rugged, commercially packed instrument for submicrosecond photography designated as Model KSC-10 Kerr Cell Camera has been designed by Electro-Optical Instruments, Inc., of Pasadena, Calif. The camera features an effective exposure time of 0.1 microsecond, and shutter operation can be synchronized to the event being photographed within one millimicrosecond (10^{-9} sec.).

This instrument comprises a Graflex Crown Graphic "45" camera, an electronically gated "Kerr Cell" shutter unit, and an electronic modulator unit (EM-10) containing a "Kerr Cell" high voltage pulse generator and a synchronizing pulser. An externally applied signal activates the synchronizing pulser and provides a fast-rising pulse which can be used to trigger both the "Kerr Cell" pulse generator and the phenomenon to be photographed.

Among the transient self-luminous phenomena which may be studied are combustion, detonation, fuse and explosive studies, electrical discharges, arc formation and cathode spot phenomena.

Other areas of interest are aeroballistics, hyperballistics, and magneto-hydro-dynamics. For non-self-luminous subjects, synchronized flash lamps can be used.

The Model KSC-10 is one of a series of ultra-high-speed cameras, covering the range from milliseconds to millimicroseconds.

Film Data Recording and Reading System

The Magnavox Co., Fort Wayne 4, Ind., has announced a new system which combines the advantages of film and digital recordings. The system is applicable to any problem where a combined photographic and digital record would be advantageous.

Applications include military and civilian control systems evaluation, theodolite recording, radar recording and document file systems.

Cameras are available in 16mm and 35mm which are capable of making up to 32 exposures per second. Each exposure is a simultaneous view of the equipment under test and the related digitally coded data. At present camera speeds, 2,880 bits per second of digital information can be recorded.

The system normally includes the following: camera with digital recording head, analog to digital converter, amplifiers, relays, control units, film reading system, decoding section, print-out equipment for visual examination of data and punched paper tape output recorders to permit further processing. Magnetic tape or other output recorders can be provided.

Kel-O-Wat Fluor-O-Dodge Printer

A new, revolutionary, automatic dodging instrument for use by the photographer in making contact photographic prints has been developed by the Watson Electronics and Engineering Co., Inc., Arlington 1, Va.

Designated as the Fluor-O-Dodge, the printer utilizes a known phenomenon of fluorescent materials in a new manner to provide an automatically controlled exposing light source. Basically, an ultraviolet light excites a phosphor coating to a high degree of actinic luminosity. By the applications of varying intensities of infrared rays, the level of emission of light from parts of the coating can be made to decrease in proportion to the intensities applied. Thus, a modulated light source is formed by the quenching action of the infrared days. In practice, the negative provides the varying intensities and the modulated light source becomes a "light positive" of the negative.

The coating is comprised of millions of crystals approximately 0.0006 inch in size. The intensity of emission of each crystal can be individually controlled, thereby permitting dodging of relatively small detail. However, it has been ascertained that a separation of 1/16 inch between the negative and coating gives results which satisfy most photographers. Tests have shown that the instrument is capable of compressing negative densities from 0.3 to 1.5 to an apparent differential of 0.6 when using Bromide F2 single-weight paper. In the production of diapositives, this range is further decreased to about 0.5. It is anticipated that a considerably lower density difference will be attained when the system is incorporated in a projection type printer. Means are provided to control the degree of dodging. Printing time for normal negatives averages 10 seconds on paper, and about 5 seconds on glass plates.

The printer operates on 110 volts A.C. and uses 400 watts. Two models are available, Model 9FL-2C for 9" x 9" photography, and Model 18FL-2C for 9" x 18" photography.

FACSIMILE

COMMUNICATIONS FOR COMMERCE

During the past 8 years American Airlines pilots have relied on Facsimile for complete up-to-the-minute nationwide information . . .

Dependability is the chief factor in governing all phases of commercial flight activity. Experience on many billions of miles of safe, courteous flight has gained for American Airlines the confidence of the public. Times Facsimile weather transmission equipment has earned similar respect from American Airlines for its accurate and dependable recording of weather information.

TIMES FACSIMILE CORPORATION

540 West 58th Street, New York 19, N. Y.—1523 L Street N. W., Washington 5, D. C.

Personnel Clearing House

As a service to AFCEA members, SIGNAL will make space available in this column for those members who are interested in employment in the communications, electronics and photography industries. Any member is entitled to three insertions in the magazine on a space available basis, free of charge. Please limit your notice to 5 lines. In replying, employers are asked to address: Box ____, SIGNAL, 1624 Eye St., N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

COMMUNICATIONS OFFICER, Reserve Captain, Communications-Electronics Officer, eleven years' experience, civilian and military. Education: radio and administrative engineering. Experience: planning, designing, installing, operating, maintaining and financial accounting for teletype, radio, telephone and intercommunication systems. Box 133.

MANUFACTURERS REPRESENTATIVE, experienced in liaison engineering of contacts, procurement and negotiations at W.A.D.C., A.M.C. and Gentile AF Depot, has time for companies desiring AF business in components, basic research and systems capability. Box 134.

AVIATION ELECTRONICS ENGINEER. Available to render consultant and/or representative service in Washington, D. C. Principal fields: radio communication, air navigation and traffic control. Full or part time assignments will be undertaken. Box 135.

COMMUNICATIONS & ELECTRONICS OFFICER, Major USAF, twenty-one years' experience in programing, plans, logistics, operation, maintenance and inspection of navigational aids (air), telecommunications and fire control systems. Box 136.

CHIEF, ENGINEERING BRANCH for US Army Signal Supply Center, Far East, available on 60 days' notice for job with Government or industry in engineering management position. Present DAC GS-13 855 Series Civil Service. Will relocate with family only. Box 137.

ONE SUBSTANTIAL ACCOUNT wanted by Government manufacturers representative exclusively. Covers all phases Federal work including sales and research, contacts, and client promotion. Twenty years' actual Government contact experience, with own office building used exclusively for clientele. Per annum basis. Box 138.

Government and Military Positions Available

Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.

FORT MONROE, VIRGINIA, CIVIL SERVICE OPENINGS. Vacancies now exist for the following positions: Mechanical Engineer GS-830-13; Communications Engineer GS-801-13; Telephone Engineer GS-801-13; Crypto Communication Specialist GS-1121-9; Engineering Aide (General) GS-802-7, and Supervisory Signal Supply Officer. Applicants may write to the Office of the Signal Officer, Headquarters, United States Continental Army Command, Fort Monroe, Virginia.

FORT HUACHUCA VACANCIES
U. S. ARMY ELECTRONIC PROVING GROUND

1	Supervisory Electronic Engineer (General)	GS-855-14
2	Electronic Engineer (Instrumentation, Radio)	GS-855-13
8	Electronic Engineer (General, Instrumentation, Radio, Wire)	GS-855-12
5	Electronic Engineer (Wire Communication, Radio)	GS-855-11
1	Supervisory Electronic Scientist (General)	GS-1312-12
1	Psychologist	GS-180-11
1	Mathematician	GS-1520-13
1	Mathematician	GS-1520-11
1	Electronic Technician	GS-1671-9
1	Mathematician	GS-1520-9
1	Engineer (General)	GS-801-9
1	Management Analyst (Manpower Utilization Control)	GS-301-9
1	Military Intelligence Research Specialist	GS-133-9
1	Military Intelligence Analyst	GS-134-9
1	Publications Editor (Physical Sciences and Engineering)	GS-010-9

The Air Force Procurement Mission

(*Continued from page 22*)

people function to assure that all of the contractor's actions and expenditures are consistent with the contract provisions and are compatible with our goals.

This is a brief sketch of our general procurement approach to buying new weapon systems and the equipment requiring high-level, sustained development efforts. These purchases are made at Dayton and represent about 70% of our annual procurement dollars.

In addition to our major air weapons we have many complex items of ground support equipment which require peculiar characteristics to fulfill their support mission. It is important to recognize that in most instances the type of equipment involved must operate under extreme temperature conditions, all over the world, with maximum reliability. They are often spoken of in the same terms as standard commercial items. I can assure you, however, that when we use such terms as "Fire Truck," "Snowplow," etc., we are speaking of a highly specialized type of equipment, of relative complexity requiring special features and capacity not found in the commerical item. This sometimes leads to a lack of understanding in the public minds of the type of items really involved.

The AMA, Depot and Base buying presents our greatest area of opportunity for emphasizing the benefits of price competition. To encourage this kind of competition, we are emphasizing advertising of bids. To assure ourselves that the bidders are realistic in their proposals, we require that a capability survey (FCR) be conducted for each procurement of significant dollar value. These surveys are carried out by specialists who evaluate not only the facilities and managerial capabilities of the bidder, but also his financial status and ability to finance the work. These surveys give our buyers the necessary level of confidence in the bidders' ability to deliver and he can turn his attention to the comparative factors of cost, price and profit spreads.

Creating Competition By Advertisement

We are making a concentrated effort to increase advertising. You no doubt have read in the papers the Congressional interest that has been evidenced in recent months regarding this subject. I would be less than candid with you, however, if I did not re-emphasize that the complexity of our weapons, the lack of firm specifications, with the rapid technological changes in the military equipment we buy will continue to prevent any widespread use of the advertised method of procurement. We will, however, continue to introduce competition where possible in the negotiated procurements and utilize all the techniques available to us to protect fully the interests of the Government.

With these limited remarks, I have endeavored to give a very general picture of our more complex procurement. It would not be accurate if I gave the impression that we do not have many problems in each of the types of procurement I have mentioned. I also have had to forego any discussion of the procedural techniques and controls which are so essential to good procurement.

We in Air Force procurement dare not take a routine or prosaic approach to our tasks. As unglamorous and mechanical as many of its phases must be, it is paramount that we keep before us the critical importance and urgency of providing the strongest possible link between Government and industry. This procurement link is the basic essential to superior American airpower upon which the national survival depends.

AFCEA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Acme-Danneman Co., Inc.
Admiral Corp.
Aircraft Radio Corp.
Allied Control Co., Inc.
Allied Radio Corp.
American Cable & Radio Corp.
American Electronic Laboratories, Inc.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Ampex Corp.
Amphenol Electronics Corp.
Anaconda Wire & Cable Co.
A. R. F. Products, Inc.
Arnold Engineering Co.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Autonetics, Division of North American Aviation, Inc.
Barry Controls, Inc.
Bell & Gossett Co.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Blackburn Electronic Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co., Ltd.
Bruno-New York Industries Corp.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
Close Associates, Inc.
Collins Radio Co.
Columbia Broadcasting System, Inc.
Convair, Division of General Dynamics Corp.
Cook Electric Co.
Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
Designers for Industry, Inc.
DeVry Technical Institute
Diamond State Telephone Co.
Dictaphone Corp.
DuKane Corp.
DuMont, Allen B., Laboratories, Inc.
Eastman Kodak Co.
Electronic Associates, Inc.
Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp.
Farnsworth Electronics Co.
Federal Telecommunication Laboratories
Federal Telecommunication Laboratories—West Coast Branch
Federal Telephone & Radio Co.
General Aniline & Film Corp.
General Cable Corp.
General Communications Co.
General Electric Co.
General Telephone Corp.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Hallamore Electronics Co.
Haller, Raymond and Brown, Inc.
Hallicrafters Co., The
Haloid Co.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hitemp Wires, Inc.
Hoffman Laboratories, Inc.
Hogan Laboratories, Inc.
Hoover Electronics Co.
Hopkins Engineering Co.
Hughes Aircraft Co.
Hycon Eastern, Inc.
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
International Business Machines
International Resistance Co.
International Telephone & Telegraph Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Kellogg Switchboard & Supply Co.
Kin Tel
Kleinschmidt Laboratories, Inc.
Koiled Kords, Inc.
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Lenkurt Electric Co.
Lewyt Manufacturing Corp.
Lockheed Aircraft Service, Inc.
Loral Electronics Corp.
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Magnavox Co.
Materiel Telephonique Co.
Michigan Bell Telephone Co.
Montgomery Co., The
Motorola, Inc.
Mountain States Telephone & Telegraph Co.
Mullard Ltd.
Muter Co.
Mycalex Corporation of America
National Co., Inc.
Nelson Technical Enterprises
Nems-Clarke, Inc.
New England Tel. & Tel. Co.
New Jersey Bell Telephone Co.
New York Telephone Co.
North Electric Co.
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Co.
Otis Elevator Co., Electronic Division
Pacific Mercury Television Mfg. Corp.
Pacific Telephone & Telegraph Co.
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Page Communications Engineers, Inc.
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Philco Corp.
Photographic Society of America
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Prodelin Inc.
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Southern Bell Telephone & Telegraph Co.
Southern New England Telephone Co.
Southwestern Bell Telephone Co.
Sperry Gyroscope Co., Division of Sperry Rand Corp.
Sprague Electric Co.
Stackpole Carbon Co.
Standard Telephone & Cables, Ltd.
Stanford Research Institute
Stelma, Inc.
Stewart-Warner Corp.
Stoddart Aircraft Radio Co.
Stromberg-Carlson Co., Division of General Dynamics Corp.
Surprenant Mfg. Co.
Sylvania Electric Products, Inc.
Technical Materiel Corp., The
Tele-Dynamics, Inc.
Telephonics Corp.
Teletype Corp.
Tensolite Insulated Wire Co., Inc.
Texas Instruments, Inc.
Times Facsimile Corp.
T.M.C. (Canada) Ltd.
Trad Electronics Corp.
Transitron Electronic Corp.
Triad Transformer Corp.
Tung-Sol Electric, Inc.
Union Carbide Corp.
United Telephone Co.
United Transformer Co.
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Webster-Chicago Corp., Government Division
West Coast Telephone Co.
Western Electric Co., Inc.
Western Union Telegraph Co.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Wheelock Signals, Inc.
Wickes Engineering & Construction Co.
Wilcox Electric Co., Inc.
Willard Storage Battery Div., Electric Storage Battery Co.
Wisconsin Telephone Co.
Wollensak Optical Co.
Zenith Radio Corp.

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Association affairs

EDITOR'S QUESTIONNAIRE

We are grateful to all those who have responded to our questionnaire on the reading content of SIGNAL and its advertising. During the first twenty days after mailing, answers were received at the rate of 100 per day. There is plenty of time to mail your copy if you have not done so to date. We will start our analysis of all questionnaires on April the first and publish the final statistics in a later issue of SIGNAL.

AFCEA "Ham Net" Growing

In response to our article in the January issue (page 62) "AFCEA Radio Amateurs on the Air" an increasing number of call letters have been received at both National Headquarters and by Ray Meyers, at 717 Anderson Way, San Gabriel, California, Vice President of Region F on the West Coast. The following are the call letters received from other AFCEA members since the publication of the first listing on page 62 of the January issue:

W1's TUP-40CW, UCD, VSS, FL
W2's PF, VU, HF, KH
W3's CV, II, UGR
W4's ex-KV, DIH, TFA
W6's AOI, GYH, UJL, RLZ, BGH, BMC, QMM
W7's AK, AYV
W9's GRW, EGX, JOU15, CTZ, AC, AQS
WØ's MMB, CXX, WYR, MEF, AFØMEF
Mars A2Pf, A7BC, A9GRW
K2BWQ
K4's AQV, MGM-Mars AAF4MGM, PAB
K6's YJB, GT, QVT
K9JJJ, KØDWC
N9WBI

Many encouraging comments have been received from the "Ham Operators." Some are given below as items of interest:

"Terrific idea;" "Keep up the good Work;" "Running flea power but put in my order for a kilowatt;" "Here's a few snaps of both my stations;" "Please advise Ray to count me in."

Let's keep sending additional call letters to swell the total of "83" received as of this writing.

This worthy project will attract national and international interest and at the same time provide AFCEA a radio "Ham Net" second to none. When more call letters are received it is our intention to publish an AFCEA Radio Ham directory. Call your buddy and tell him about SIGNAL.

BASEBALL

The following may be of interest to baseball fans attending the AFCEA Annual Convention in Washington, D. C., June 4, 5 and 6, 1958.

During the time of the Convention the Kansas City Athletics and the Detroit Tigers will be playing at Griffith Stadium. The Kansas City Athletics will play night games on the 4th and 5th of June at 8:00 p.m. The Detroit Tigers will play the Washington Senators at 8:00 p.m. on June 6th. Tickets are available for purchase at the box office before game time at $2.50 for box seats, and $2.00 for reserved grandstand seats.

New Regional Vice President

Paul H. Clark, manager of the Dayton office of the Radio Corporation of America, Defense Electronic Products, has been appointed Regional Vice President of the AFCEA to cover Kentucky, Ohio, West Virginia and western Pennsylvania.

Mr. Clark was president of the Dayton-Wright Chapter from December 1951 to June 1953 and since then has been a member of its board of directors. His region, designated as Region B2, comprises the western half of the previous Region B. The present active chapters in this region are Dayton-Wright, Lexington and Pittsburgh. Regional Vice President George C. Ruehl, Jr., whose area was Region B, will cover the eastern portion of that area, now known as Region B1.

The appointment was made by the National Executive Committee at its quarterly meeting held in Washington, D. C., on February 14th, and is in line with provisions made at the 1957 National Convention for the appointment of additional regional vice presidents, where feasible, to assure closer and more frequent contact with the various chapters.

Message

From the Executive Vice President's Desk

The Executive Vice President must travel extensively to chapters if he is to gain comprehensive information on their activities; he must get out into the field and meet the chapter presidents, other officers, and local AFCEANS if he is to spread firsthand and effectively the views and doctrines of National Headquarters. Visits to chapters are valuable for reasons well understood beforehand: opportunities to meet outstanding people; chances to discuss intimately the problems that particularly apply to certain localities, and to meet representatives of prospective group members, as well as prospective individual members; stimulation on both sides; and of course the gaining of important, distinctly useable knowledge and experience.

Since last September 30th, I have visited thirteen chapters, and my experiences have been so refreshing and beneficial that my firm intentions to continue the practice without let-up have, if anything, been strengthened. During the last quarter of Calendar 1957, I attended meetings of these chapters: Washington, Baltimore, Philadelphia, New York, Boston, and St. Louis. In January I made a seventeen-day automobile trip, in which I went to Fort Bragg, North Carolina; Charleston; Fort Gordon (Augusta), Georgia; Eglin Air Force Base, Florida; St. Petersburg, Florida, and Orlando, Florida.

In planning the itinerary for the long January trip, I tried at first to arrange my travel so that I might be at each of the chapters when a regular meeting was scheduled, but I quickly discovered that only Utopian conditions would permit this and that it was impractical to dovetail chapter meeting dates that had already been decided on locally. As a result, I established one firm date and place and then worked backward and forward in terms of dates, times, and places so that the whole scheduled route might be most effectively covered. In this new procedure, I wrote to each chapter concerned, requesting that arrangements be made for me to hold a business meeting, at least, with a view of my attending a chapter meeting if one could conveniently be scheduled during the period of my visit. I pointed out that discussion of AFCEA problems, aims, and matters in general was one of my main purposes. Afterwards, I was able to say definitely that some sort of business meeting with the major officers of the chapter, whether held before or after the main gathering, is exceptionably effective and desirable as a regular procedure, and that a short talk of from five to fifteen minutes on AFCEA matters, given just before the main speaker or entertainment feature of the evening, can be uniquely effective.

The distance was roughly 2700 miles, though between six and seven hundred more miles were registered for various reasons. The first chapter visited was North Carolina, which held its January meeting at Fort Bragg on the evening of 14 January. Mr. James R. Fowler of the Carolina Telephone and Telegraph Company was elected the new president. Colonel Henry Hort, Signal Corps, USA, who has served faithfully and ably as secretary for many months, gave his instruments of office to Mr. John C. Coley.

Next came the 215-mile ride to Charleston, where at 1500 on Wednesday, 15 January, I arrived in time for a group picture in the Citadel office of General Mark Clark, one of AFCEA's most prominent members. This picture and a "plug" by the newscaster came over a local television channel the same evening. The South Carolina Chapter meeting of 15 January, presided over by President Harry Rodin, was attended by about 190.

At Augusta during the evening of 16 January, President James M. Williams presided over the Augusta-Fort Gordon Chapter meeting, at which RAdm. F. R. Furth, AFCEA's National President, also gave a short talk.

On 21 January, at Atlanta, Lt. Colonel D. L. Adams, USA, the president of the Atlanta Chapter, presided at a noon luncheon and business meeting and at the regular chapter meeting during the evening.

The Florida chapters held their meetings as follows: Northwest Florida, headed by Colonel R. B. H. Rockwell, USAF, during the evening of 22 January at Eglin Air Force Base; Central Florida, under Mr. Willard Moor, at St. Petersburg Beach on 24 January, and the Orange Chapter, presided over by Mr. Eugene Johnson, in Orlando on the night of 27 January.

I intend to visit chapters at every opportunity, realizing there is no substitute for the personal contacts that such visits permit. Because of factors of time and funds, each visit must be carefully planned, and the same factors make it desirable to combine visits wherever practicable.

One outstanding fact that I learned over and over during these visits is that each chapter tends to reflect the personality of its president.

Remember our 1958 Convention, to be held on June 4, 5, and 6 at the Sheraton Park Hotel in Washington, D. C.!

W. B. "Bill" Goulett

AFCEA CHAPTERS—National Director of Chapters: Maj. Gen. Alvin L. Pachynski, USAF

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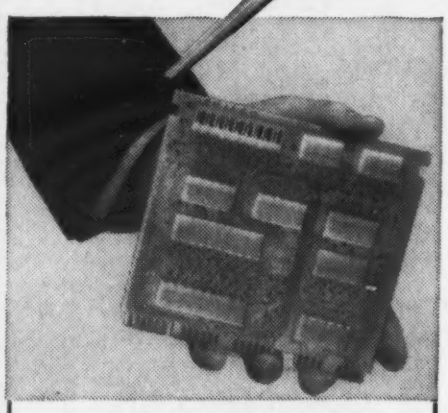

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Chapter News

Atlanta

One hundred and eighty members and guests were present at the dinner-meeting held on January 21st at the Fort McPherson Officers Club. Special guest and speaker of the evening was AFCEA Executive Vice President W. B. Goulett, who was introduced to the gathering by W. O. McDowell, program chairman.

President Don Adams announced the appointment of William G. Burnett, Southern Bell, as new membership chairman. He also commended committee members Mel Butler, Vic Cain and Lt. Col. Tom Pugh on the excellent meeting arrangements. He then introduced three Southern Bell hostesses who had handled the registration for the evening: Mrs. Jerry Walden, Miss Ann McMichael and Miss Ruby Terry.

During the day, chapter officers and directors met with Captain Goulett at a luncheon-meeting for the discussion of chapter business. Present were: Lt. Col. Donald L. Adams, president; W. B. Bryan, vice president; E. F. Stuart, vice president; "Gus" Wilson, secretary-treasurer; Col. Kirk Buchak, director, who was formerly president of AFCEA's Arizona Chapter; A. J. Cartey, director; W. O. McDowell, program chairman; W. G. Burnett, membership chairman, and Ralph S. Grist, AFCEA Regional Vice President.

Atlanta—Pictured at the January 21st meeting at Fort McPherson are, left to right: William B. Bryan, chapter vice president; AFCEA Executive Vice President W. B. Goulett, and Lt. Col. Donald L. Adams, chapter president.

Augusta-Fort Gordon

AFCEA's National President, Rear Adm. F. R. Furth, USN (Ret.), was guest speaker at the chapter's January 16th dinner-meeting. Also a guest of the chapter was Captain Goulett, who followed Admiral Furth's talk on national association activities with a report on headquarters operations and chapter affairs.

The previous day, Admiral Furth, who is Director of Research and Engineering at International Tel. and Tel. Corp., had addressed the Signal Training Center's monthly officers' call meeting on the subject of "Research and Development in Communications."

President James M. Williams appointed Col. Darce R. Knight chairman of a committee to draw up plans for a chapter award to a local citizen for outstanding service to the community in the communications field. Mr. B. M. Wilson and Capt. M. L. Blaustein were named for the selection committee.

Augusta-Fort Gordon—Informal group shown during the January 16th meeting, left to right: James M. Williams, chapter president; J. C. Phillips, Augusta district manager for Southern Bell; Rear Adm. F. R. Furth, USN (Ret.), AFCEA National President; Col. David P. Gibbs, C. O., Army Signal Training Center; Brig. Gen. David Schorr, Fort Gordon Provost Marshal General Center, and Capt. W. B. Goulett, USN (Ret.), AFCEA Executive Vice President.

Baltimore

The Martin Company was host to the chapter on November 19th. Principal speaker was Vernon J. Crouse, group engineer in charge of the design instrumentation and telemetry systems for flight tests of Project Vanguard's satellite launching vehicle, for which the Martin Company is prime contractor. Mr. Crouse gave the AFCEA group an illustrated description of the project.

The lecture was further illustrated by the Martin film "Horizons Unlimited," which described the Viking rocket, and the International Business Machines film "A Moon Is Born."

An "unclassified" tour of the Martin plant concluded the evening's program.

The role of electronics in the field of medicine was highlighted at the January 21st meeting, held at the University Hospital in Baltimore.

Participants in the program on medical electronics were the following members of the staff of the University of Maryland School of Medicine:

Bruce W. Armstrong, M.D., Assistant Professor of Surgery; Samuel Bessman, M.D., Associate Professor of Pediatrics; R. Adams Cowley, M.D., Assistant Professor of Surgery; William G. Esmond, M.D., Instructor, Department of Surgery; Martin Helrich, M.D., Professor of Anesthesiology; Jerome K. Merlis, M.D., Professor of Clinical Neurophysiology; Leonard Scherlis, M.D., Director, Division of Cardiology; William S. Stone, M.D., Dean and Director of Medical Education and Research; Morris Tischler, M.A., Research Associate, Department of Surgery, and Fellow, Department of Medicine, and Joseph B. Workman, M.D., Assistant Professor of Medicine. Mr. Tischler, a member of the Baltimore Chapter, served as program chairman and introduced the evening's program.

Case presentations covered: 1. general medical work-up and cardiological studies — ECG, phonocardiograph, dye dilution, etc.; 2. radiologic studies and radiography—films, fluoroscopy, image amplifier, tracer and dilution techniques, contrast studies of vascular system; 3. specialized analytic techniques, pressure measurement, blood oxygenation determination, etc.; 4. summary of diagnostic study; 5. surgical approach to the therapeutic problem; 6. anesthetic management; 7. preservation of life with heart and lungs excluded from circulation; 8. biochemistry of nos. 6 and 7; 9. neurophysiology during nos. 6 and 7.

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The objective of much of the Center's electronics research is to improve the systems and instruments that serve as visual and auditory senses for the Air Force, making it possible to control and detect the incredibly fast missiles and planes of today and tomorrow. Such work has included development of "super systems," such as the SAGE air defense system, which provides coordinated aerial detection and interception over a vast area. Other projects include mobile, tactical air control systems (TACS); advanced radar for ground, aircraft and missile systems; automatic aerial traffic control systems, such as VOLSCAN; research in computer techniques, as well as creating computers for Cambridge's own use; and extensive work in communications, data processing, magnetics, radiochemistry, weapons control systems, and many other fields.

Cambridge is cooperating closely in the International Geophysical Year – as well as doing its own research into meteorology, auroral physics, storm detection and weather forecasting techniques, the upper atmosphere, meteor physics, jet stream research, and many other areas now becoming of intense interest to practical science.

This Center is also responsible for a broad program in "human engineering." It is concerned with research on hearing, speech intelligibility, and information processing by the human operator. Other studies involve the human limitations and capabilities of members of complex communications and control networks.

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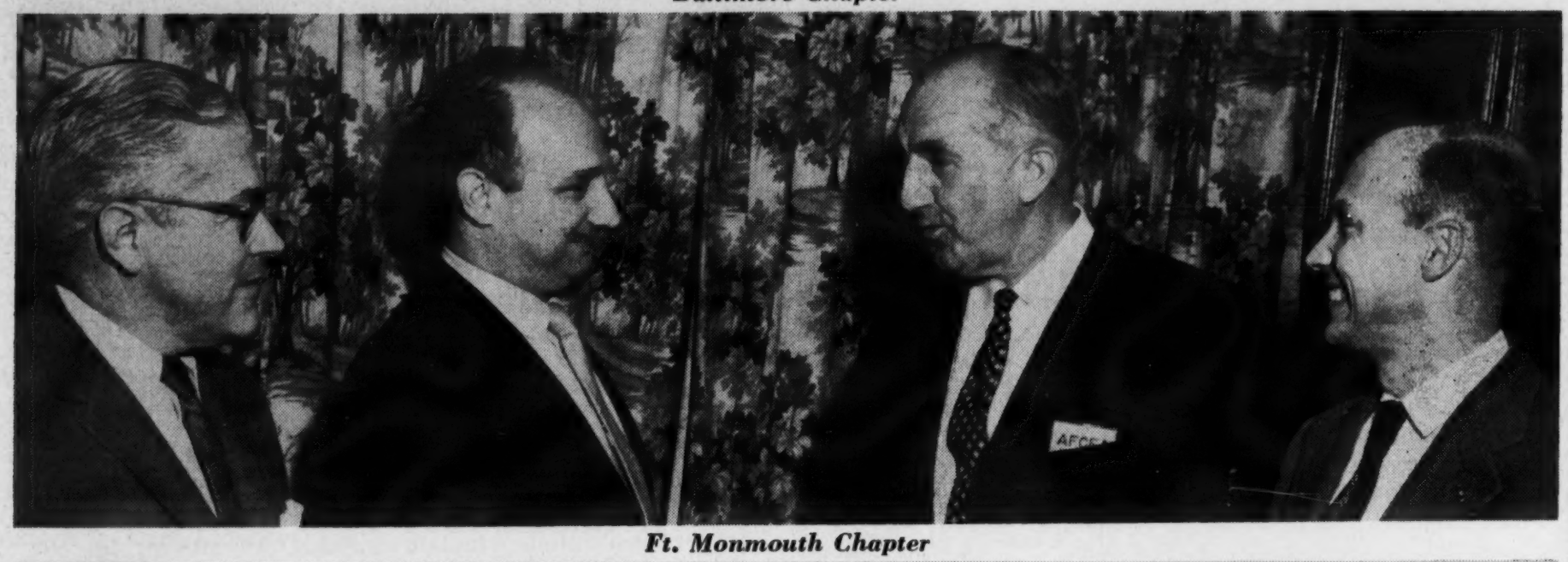
Baltimore Chapter



Ft. Monmouth Chapter

Boston Chapter

Boston

The Smithsonian Astrophysical Observatory was host to Boston Chapter members and guests on January 9th and presented an authoritative evaluation of the earth satellite program.

Staff members of the observatory addressed the group on the following subjects: C. M. Peterson, Chief of Communication Staff, Optical Satellite Tracking Program — "Communication Problems During the Early Days of Sputnik Launching;" E. S. Fergusson, Senior Consultant, Optical Satellite Tracking Program—"The Communication Network of the Satellite Tracking Program;" Dr. J. S. Rinehart, Assistant Director, Smithsonian Astrophysical Observatory — "Status of U.S.A. and U.S.S.R. Satellite Projects," and Dr. G. F. Schilling, Executive Assistant to the Director, Smithsonian Astrophysical Observatory—"Inferences About Scientific Telemetering Aboard the U.S.S.R. Satellites."

The audience interest in the program was evidenced by the lengthy question and answer period which followed the series of talks.

The meeting was held in the library of the Harvard College Observatory. The more than 100 members and guests present first attended a social hour and dinner at the Commander Hotel in Cambridge.

Central Florida

Chapter officers met with Executive Vice President W. B. Goulett on January 24th at the Desert Ranch Motel in St. Petersburg.

The evening was devoted to a thorough discussion of chapter problems.

(*Continued on page* 54)

←

Baltimore (top photo)—Dr. William S. Stone, M.D., Dean and Director of Medical Education and Research, University of Maryland School of Medicine, addresses the January 21st chapter meeting held at the University Hospital. Seated, left to right, are Henry B. Yarbrough, chapter president; George C. Ruehl, AFCEA Regional Vice President, and Morris Tischler of the hospital staff, who directed program arrangements for the meeting.

Fort Monmouth (center photo)—Brig. Gen. A. F. Cassevant (second from right), Commandant, U. S. Army Signal School, welcomes George Rappaport of Emerson Radio, who was guest speaker at the chapter's January meeting. Looking on are, at left, Halsey Hubbard, chapter president and, at right, Col. Robert Haffa, chairman of the membership committee.

Boston (bottom photo)—The Smithsonian Astrophysical Observatory was host to the chapter on January 9th. Dr. G. S. Rinehart, assistant director, points out the earth satellite course to Col. Murray D. Harris, chapter president, while observatory officials Dr. G. F. Schilling (left), executive assistant to the director, and C. M. Peterson, chief of communication staff, optical satellite tracking program, look on.

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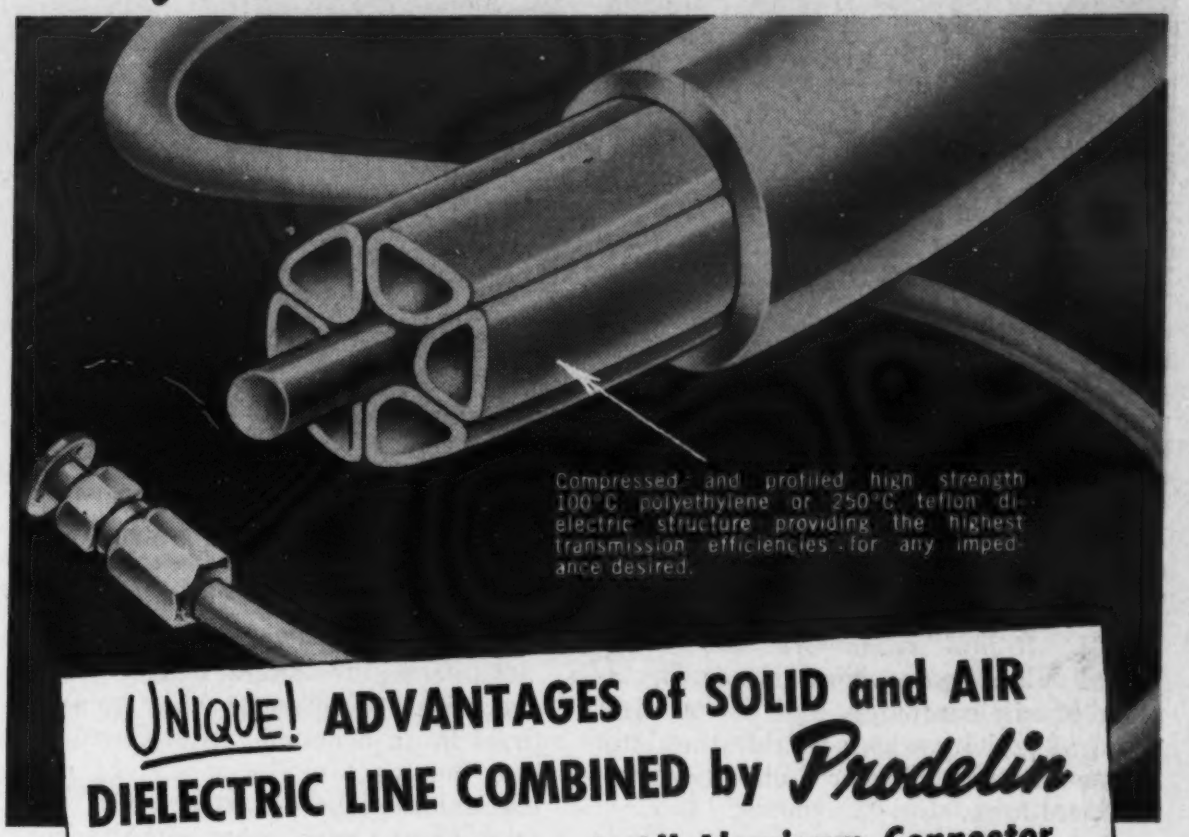
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New York—Honored guests and speakers are pictured at the January 29th pre-dinner reception. From left to right, Col. Ludwig R. Engler, chapter president; Dr. G. Truman Hunter, consultant, Executive Development Department, IBM, and T. V. Learson, vice president and group executive, IBM; J. Blatt, deputy regional administrator, Civil Aeronautics Administration, and D. Ross of IBM's Military Engineering Products Division.

Initial plans were formulated for a membership campaign and for a program of activity which would stimulate interest in the chapter's objectives in the local area.

Fort Monmouth

Members and guests of the chapter attended their first 1958 dinner-meeting at Gibbs Hall Officers Club on January 16th. George Rappaport of the Emerson Radio and Phonograph Corporation was the guest speaker.

Mr. Rappaport, vice president in charge of the company's Special Projects Division, spoke on the subject, "Electronic Counter Measures," following the dinner and short business period.

New York

Two unique and interesting applications for computers were described by Mr. D. C. Ross and Mr. G. Truman Hunter of IBM at the first meeting of the year held on January 29th at the Belmont Plaza Hotel.

Mr. D. C. Ross of IBM Military Engineering Products Division discussed "High Speed Simulation" as a new and flexible research tool in the field of air traffic control. After a review of the air traffic problem, discussing in particular the "Victor Airways" in the New York Metropolitan area, Mr. Ross described the method by which a computer can be programmed to simulate several hours of airway operating time, giving, in a matter of minutes, the statistics required to analyze the functioning of a complete airways system.

The second speaker, Dr. G. Truman Hunter, Consultant, Executive Development Department of IBM, outlined the unique application of a computer for the training of executives.

The computer enables three teams of executives to operate three competing firms in an economic environment built into the machine by means of mathematical models. Starting with a balance sheet, each team simultaneously makes the business decision of price, R&D investment, plant and marketing which by means of the computer enables the three "firms" to do a year's worth of business in one hour, and five years' in one day. The executive game demonstrates economic principles and teaches the students to analyze their business decisions more carefully. In addition, the students gain experience in delegating authority and in avoiding team conflicts.

North Carolina

James R. Fowler, Secretary-Treasurer of the Carolina Telephone and Telegraph Company, Tarboro, was elected president at the chapter's annual elections on January 14th. Guest speaker at the meeting, which was held in the main ballroom of the Fort Bragg Officers Open Mess, was Capt. Wilfred B. Goulett, AFCEA Executive Vice President.

Other officers chosen for the year 1958 were: 1st vice president—Col. Ray Bagley, 1st Logistical Command, Fort Bragg; 2nd vice president—W. Thomas Edwards, Southern Bell Telephone and Telegraph Co., Charlotte, who was recently a vice president of the South Carolina Chapter; secretary-treasurer—John C. Coley, Carolina Tel. and Tel., Fayetteville; national council member—Luke W. Hill, president of the Carolina Tel. and Tel. Co.

Northeastern University

New officers of the chapter's two divisions have been elected as follows: Division A: president—Edward O'Keefe; vice president—Thomas R. King, Jr.;

North Carolina—Newly elected officers, shown at the January 14th meeting, are, left to right: John C. Coley, secretary-treasurer; James R. Fowler, president, and Col. Ray Bagley, 1st vice president. W. Thomas Edwards, 2nd vice president, was not present at the time the photo was taken.

Rome-Utica—Photographed during the January 15th meeting, left to right: seated—Brig. Gen. Clyde H. Mitchell, commander, Rome Air Force Depot; Maj. David G. Simons, dinner speaker; Richard C. Benoit, Jr., dinner chairman. Standing—Col. George M. Knauf, commander, RAFB Hospital; Allen A. Kunze, AFCEA chapter president; Dr. Charles H. Alessi, president, Rome Academy of Medicine.

secretary — William C. Regan, Jr.; treasurer—Robert Doyle. Division B: president—Leonard Y. Lewis; vice president—Harry F. Giberson; secretary—John Barros; treasurer—Richard Garvin.

Scheduled program for the winter-spring term: January 29—introduction of new members and business meeting; film, "Combat Photographer." February 5—organization of committees; film, "Invasion of Sicily." February 12 — lecture, "Scatter Communications" presented by Mr. Tom Rogers of Cambridge Air Force Research Center. February 26—business meeting. February 27—lecture, "Our Missile Program and What We Expect to Learn," presented by Dr. John Rinehart, Asst. Director of the Smithsonian Astrophysical Observatory. Joint meeting with the Society of American Military Engineers. March 5—field trip to Air Control Center at Logan International Airport. March 12—photography lecture. March 19—field trip to Boston Naval Shipyard to view electrical and electronic departments of a combat vessel. March 26—convention plans; business meeting. March 7—combined meeting, Division A & B; illustrated-color-lecture on Europe.

Orange

Meeting on January 27th at the Elks Lodge, Lake Eola, Florida, the chapter installed its new officers as follows:

President—Eugene S. Johnson, Johnson Electronics, Inc.; vice presidents—Lewis A. Brown, Southern Bell Telephone and Telegraph Co.; Maj. Morris R. Muse, Air Rescue Service; Lt. Col. Donald E. Dobbins, USAF (Ret.), and H. R. Weaver, Minute Maid Corp.; secretary—Vince Meder, Radiation, Inc.; treasurer—Col. George M. Smith, USAF (Ret.), Hall Bros.

Captain Goulett, AFCEA Executive Vice President, special guest of the chapter, addressed the group and stressed the vital mission of the AFCEA in the fields of communications, electronics and photography.

The meeting concluded with the showing of a Western Electric film on communications.

Pittsburgh

Some time ago, the United States Air Force assigned to the Bell Telephone Laboratories the job of developing a new kind of electronic computer. This computer, known as "Leprechaun" to its designers, was the subject of the chapter's January 23rd meeting.

The program was presented by J. A. Githens of the Bell Telephone Laboratories, who discussed the computer, its design, construction and the operating experiences. He stated that, since the major requirement had been greater simplicity, the "Leprechaun" is much smaller and simpler than most of the computers currently in use. It has only 9000 electrical components; 5000 of them are transistors. As a result, the computer has less than one-third the components of conventional computers. This facilitates testing, experimentation, assembly and service.

Included in the presentation was a discussion of the use of direct coupled transistor logic and the operation of the magnetic core memory.

The meeting was held at the Penn Sheraton Hotel, with dinner at the H.Y.P. Club. Program arrangements were under the direction of Sam Phillips, General Commercial Manager of the Bell Telephone Company and a past president of the chapter, who was host at a cocktail party preceding the dinner.

Rome-Utica

Maj. David G. Simons, Chief of Space Biology Branch, Aero-Medical Field Laboratory, Holloman Air Development Center, New Mexico, addressed a joint meeting of the Rome-Utica Chapter and the Rome Academy of Medicine on January 15th. His appearance delayed an hour and a half by poor flying weather, the major was greeted with a standing ovation by the audience of some 500 persons, which included 50 high school and junior high school students.

The *Utica Daily Press* reported the meeting as follows:

"Maj. David G. Simons described here last night his adventure of soaring to a record 102,000 feet into the atmosphere in a balloon to prove that man can fly in outer space.

"The 35-year-old officer. who holds a medical degree, told an audience of some 500 that 'the stream of current events makes it unmistakably clear that mankind is determined to conquer space.

" 'The critical question is not "Can man conquer space?" but "How and when will he conquer it?" '

"Maj. Simons, who is Chief of Space Biology Branch, Aero-Medical Field Laboratory, Holloman Air Development Center, New Mexico, spoke here before Armed Forces Communications and Electronics Association and the Rome Academy of Medicine at The Beeches. The session was open to the public after the dinner - meeting of the two groups.

"Maj. Simons' 19-mile trip into the sky last August to determine whether man can survive in outer space received international attention.

"The ascent which started in Crosby, Minn., and ended in a flax field in South Dakota, was made in a giant polyethylene balloon, 280 feet long and 200 feet in diameter launched from a 450-foot mine pit.

"The officer was sealed in a three by eight-foot gondola, packed with instruments, and conditioned to temperatures of 70 degrees below zero at night and 250 degrees of heat in the daylight sun.

"Maj. Simons said that 'at balloon altitudes, man is exposed to approximately half of the heavy primary cosmic radiation flux which he would receive in orbited flight.

" 'We must learn not only what man can be expected to see and do by way of observation and productive activity under space-equivalent conditions, but we must also learn what factors destroy initiative and effectiveness so that we can control them,' he said.

"He said the marked brilliance of the clouds below him made the sky above 'seem black . . . or completely absent.'

" 'This gave me the impressoion that I was suspended above a large soup bowl with slightly inverted, upturned edges and without a top.

" 'Observing the faintly curved horizon, it took very little imaginaiton to feel as if I were on the very fringes of the atmosphere—closer to space than to the earth.

"At altitudes of between 90,000 and 100,000 feet, Maj. Simons noted that 'the stars did not twinkle' when he viewed them through a special five-inch

Scott-St. Louis— Head table at the January 10th meeting, left to right: John W. Heskett, Jr., Southwestern Bell Tel. Co.; Harry L. Cooper, AT&T Long Lines, chapter director and past president; Allan L. Eisenmayer, Scott AFB, chapter secretary; James V. C. Harter of RCA, guest speaker; B. R. Robards, Southwestern Bell Tel. Co., chapter president; William Clark, Interstate Supply Co., and A. L. Lenny, Alton & Southern RR, chapter vice president.

telescope with a 60-inch focal length, or with the naked eye.

"This emphasizes, he said, the importance of 'conducting an experiment to evaluate specifically the improvement of seeing from this altitude range.'

"In addition, he said the color of each star was much more distinct so that 'red stars appeared redder and blue stars appeared bluer.'

" 'I had the impression that there was a slight increase in over-all night sky brightness, but this would have to be measured to be accurately confirmed,' he added.

"He said the balloon was 'remarkably stable' in floating at the high altitudes.

"During the ascent, he said colors on the ground had already begun to fade at about 70,000 feet. He said he could distinguish 'only a gray haze at an angle of 45 degrees' from directly beneath his sealed capsule.

" 'Greens and reds were still distinguishable but (they) had a faded pastel appearance and a somewhat bluish cast as if I were looking down into a blue-tinted filter,' he said.

"He said the Missouri River Valley stood out like 'a broad green band' from an altitude of 90,000 feet. He said he could trace the river's path for almost 150 miles.

"At 100,000 feet, he said the smooth line of clouds forming the horizon toward the west and southwest was 'punctuated by a build-up clearly outlined against the horizon. This structure stood out so distinctly from the other

South Carolina—The above picture was taken of a special conference in the office of General Mark W. Clark, President of The Citadel, prior to the regular chapter meeting on January 15th. Standing, left to right: Col. R. M. Byrd, Academic Dean of The Citadel; Col. Charles T. Razor, head of electrical engineering department, The Citadel; Lawrence Davis, Southern Bell T&T Co., chapter secretary-treasurer; Cmdr. Harry C. Rodin, Charleston Naval Shipyard, chapter president; W. O. Kiger, Southern Bell T&T Co., chapter first vice president; Col. Anderson, head of the physics department, The Citadel. Seated, left to right: Col. Eugene C. Figg, of the Board of Visitors, The Citadel, and AFCEA member; Col. W. P. Thorington, commander of the Charleston Air Force Base; AFCEA Executive Vice President Wilfred B. Goulett; General Mark W. Clark, President of The Citadel, and AFCEA member; Capt. William I. Bull, commander of Charleston Naval Shipyard and former director of AFCEA's Washington Chapter; Rodney D. Chippe of the Federal Telecommunications Laboratories, who was principal speaker at the chapter dinner-meeting that evening. General Clark's pet cocker spaniel also posed for the picture.

clouds that a special note was made of it and a later check revealed that there was unusually violent thunderstorm activity in the vicinity of Denver, Colo., at the time of the observation.'

"He termed balloon systems of the type he used 'extremely valuable' for gaining experience in the practical designs and use of manned satellite observatories.

"The man-reaction problem, he said, 'is likely to be even more difficult in a satellite since there will not be a balloon with its enormous rotational movement of inertia (due to its large diameter) to serve as a stabilizing force.'"

Opening remarks were made by Allen A. Kunze, president of the Rome-Utica Chapter, and Dr. Charles H. Alessi, President of the Rome Academy of Medicine. Major Simons was introduced by AFCEA member Richard Benoit, who was dinner chairman.

Scott-St. Louis

James W. Harter, Manager, Color Market Development, Radio Corporation of America, Kansas City, presented "The Story of Television" at the January 10th dinner-meeting.

The program began with the RCA film, "The Story of Television," partly narrated by General David Sarnoff, which traced the history of television through the past quarter century up to present-day color television. Mr. Harter followed with a talk giving additional information on the program subject.

During the business session, a "past president's" AFCEA gold lapel button was presented to Harry L. Cooper, who had served as chapter president in 1955-56 and who had been absent on the occasion of the December 6th anniversary-dinner at which similar presentations had been made to Col. Charles W. Gordon and Walter W. Van Skiver.

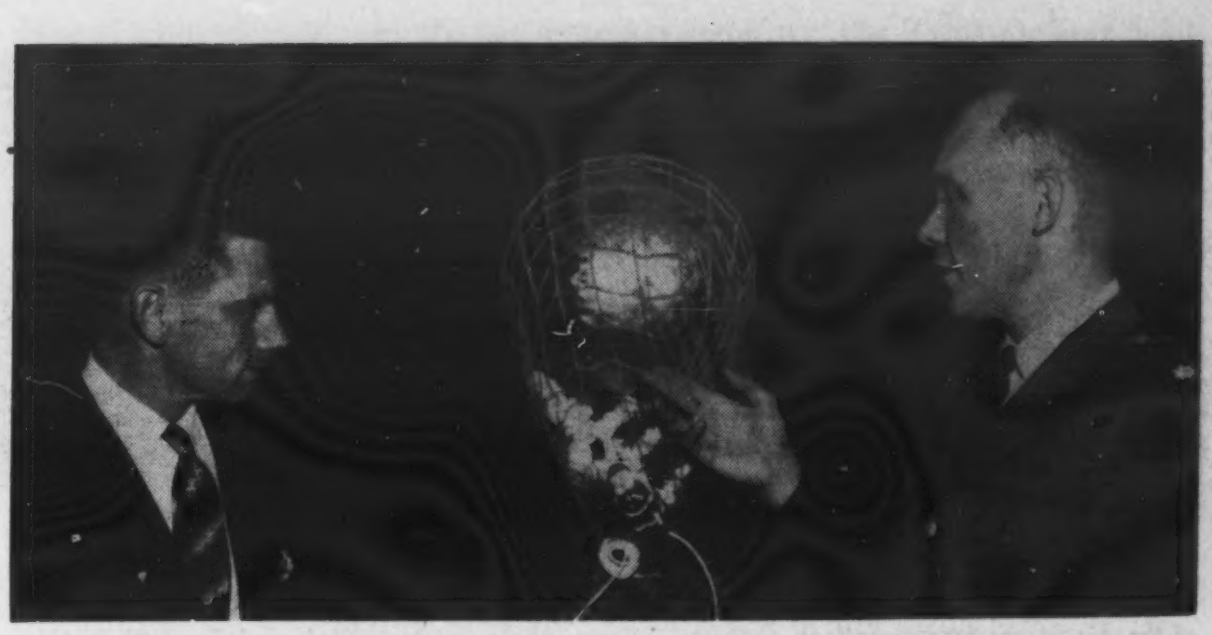
South Carolina

The chapter held a dinner-meeting at the Charleston Air Force Base Officers Club on January 15th, with 198 members and guests present.

Speaker for the occasion was Rodney D. Chippe, Manager of System Engineering of Federal Telecommunications Laboratories, who spoke on "Tropospheric Propagation," a new technique for the transmission of high frequency radio and television signals. An informal question and answer period followed his presentation.

Captain W. I. Bull, USN, Commander of the Charleston Naval Shipyard, and Colonel W. P. Thorington, USAF, Commander of the Charleston Air Force Base, spoke briefly to members about the part communications and electronics play in the operations of their respective branches of the Armed Forces.

Other guests introduced by Commander Rodin, Chapter President, included Captain Wilfred B. Goulet, USN (Ret.), National Executive Vice President, who also spoke briefly on AFCEA matters; Colonel C. T. Razor, Professor of Electrical Engineering of The Citadel; Lt. Colonel A. W. Hanson, Associate Professor of Physics of The Citadel, and Captain O. L. Herring, Jr., Associate Professor of Electrical Engineering of The Citadel.



South Texas—Col. Albert H. Snider, USAF, chapter president (left), presents Maj. David G. Simons, USAF, guest speaker for the December meeting at Randolph Field, with a replica of the balloon in which Major Simons made his flight to the fringe of outer space.

South Texas

The December meeting of the South Texas Chapter proved to be one of the most popular and interesting programs of the entire year.

The guest speaker was Major David G. Simons, who in August of 1957 established the balloon flight record of 102,000 feet, for which he received the Distinguished Flying Cross.

Major Simons supported his most interesting discussion of "Operation Man High" by excellent colored movies taken during that flight, showing the communications equipment and instruments used inside the sealed aluminum gondola, as well as many shots of the earth and sky taken at altitudes approaching outer space.

The presentation was a timely sequel to a previous program enjoyed by members of the chapter at the Randolph Air Force Base Officers Club in Febru-

TELEPHONE AND TELEGRAPH EQUIPMENT

Radio Engineering Products is currently producing a number of types of equipment, electrically and mechanically interchangeable with standard Bell System apparatus.

CARRIER-TELEPHONE EQUIPMENT

C5 Carrier-Telephone Terminal (J68756). A kit for adding a fourth toll-grade channel to existing C systems is available. • C1 Carrier-Telephone Repeater (J68757) • 121A C Carrier Line Filter • H Carrier Line Filter (X66217C).

CARRIER-TELEGRAPH EQUIPMENT

40C1 Carrier-Telegraph Channel Terminal (J70047C) • 140A1 Carrier Supply (J70036A1, etc.) • 40AC1 Carrier-Telegraph Terminal.

VOICE-FREQUENCY EQUIPMENT

V1 Telephone Repeater (J68368F) • Power Supply (J68638A1) • V1 Amplifiers (J68635E2 and J68635A2) • V3 Amplifier (J68649A) • V-F Ringers (J68602, etc.) • Four Wire Terminating Set (J68625G1) • 1C Volume Limiter (J68736C).

D-C TELEGRAPH EQUIPMENT

16B1 Telegraph Repeater (J70037B) • 10E1 Telegraph Repeater (J70021A) • 128B2 Teletypewriter Subscriber Set (J70027A).

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2A Toll Test Unit (X63699A) • 12B, 13A, 30A (J64030A) and 32A (J64032A) Transmission Measuring Sets • 111A2 Relay Test Panel (J66118E) • 118C2 Telegraph Transmission Measuring Set (J70069K) • 163A2 Test Unit (J70045B) • 163C1 Test Unit (J70045D).

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Washington— The February 4th meeting featured a photography program presented by Dr. William West of Kodak Research Laboratories. A portion of the head table appears above. Left to right: James A. Barker, president, Capital Film Laboratories; Dwin R. Craig, vice president and technical director, LogEtronics, Inc.; Col. Robert P. Craft, commander, Washington Office Aeronautical Chart & Information Center, Dept. of the Air Force; Fred Gerretson, Government rep., photo products dept., E. I. Du Pont de Nemours & Co.; Raymond Davis, chief of photographic technology, National Bureau of Standards, and Dr. West, the guest speaker.

ary 1957 in which Dr. Hubertus Strughold, the well-known authority on space medicine, discussed some of the physical and physiological problems involved in space flights.

A keen interest on the part of the AFCEA members in the technical aspects of space flight was evidenced by the extensive question and discussion period which followed Major Simons' presentation.

Southern California

The chapter experienced another record-breaking attendance participation at the January 6th meeting which featured "Missiles" as its subject. The meeting was held in the large Golden State Room of the Statler Hotel, Los Angeles, with approximately 200 members and guests present. Two films were shown: "Terrier," the new Fleet Weapon (Navy), and the second one titled "Seek, Find and Kill" (Falcon, USAF).

Rear Adm. Charles F. Horne, USN (Ret.), Vice President and General Manager of the Pomona Division, Convair, and a National Director of AFCEA, narrated the Navy film in color and sound, "Terrier" — the new Fleet Weapon. This film documents the first nine years of the "Terrier" program, including joint activities by the Applied Physics Laboratories of the Johns Hopkins University and the Pomona Division of Convair. This film was classified until very recently, and now is being released for limited public viewing. It portrays many actual test firings of the "Terrier," with these scenes taken aboard the *U.S.S. Norton, U.S.S. Mississippi* and the Naval Test Station in the Mojave Desert.

The second film titled "Seek, Find and Kill" portrays the story of the "Falcon" missile (fire control system) and was narrated by Col. John Atwood (SigC, USAR), Scientific Staff Relations of Hughes Aircraft Company. This color sound film tells the story of the Hughes Airborne Armament Control System and the Falcon Missile, tracing the development of aerial combat from World War I days to the complex electronic systems of the present. The Hughes System is in operational use by the United States Air Force, the Royal Canadian Air Force, and the United States Navy for all-weather interceptor service, and is a primary part of the national air-defense system.

Master of Ceremonies was L. D. Callahan, Vice President of Gilfillan Brothers, Inc., Los Angeles, and a chapter director, who introduced the featured speakers.

Washington

The "history" of a photographic film during the hundredth of a second or so of a normal photographic exposure was unfolded by Dr. William West of Kodak Research Laboratories at the February 4th meeting of the Washington Chapter. An expert on photographic sensitization, Dr. West spoke to the group on the chemistry and physics of latent image formation.

"The important property of the latent image is that it can catalyze the production of silver when the film is placed in a developer," he said.

All that is required to make the light-sensitive silver bromide grain in a photographic film developable is that a single "latent image center" containing only a few atoms of silver be produced by the exposure to light, Dr. West said.

"About 100 million times as much silver is formed by development as is formed directly by the light, and it is this enormous multiplication of the effect of the light by the development process that renders the photographic emulsion so extremely sensitive," he said.

Dr. West explained that electrical measurements of photographic materials in the dark and on exposure to light showed that the primary effect of the light was to form negatively charged electrons and an equal number of positive charges. Trace amounts of sensitizing materials, acting as tiny "traps," allow the electron to combine with silver ions, thus initiating the formation of the latent image.

"Latent-image formation is an example of one of those interesting processes controlled by trace amounts of material in a mother matrix which are being recognized as of prime importance today in many branches of chemistry and physics," he said.

visit*

* the afcea-signal booth 4023 at the ire show, march 24-27, nyc

and guidance to the target, while humans are used for monitoring the equipment and injecting elements of judgment when necessary to support the electronic system in its automatic operation.

The Talos Land Based System is an automatic defensive, surface-to-air weapon system which has as its primary function the efficient protection of our military bases and industrial centers against air threats—both subsonic and supersonic. The weapon system, to contribute effectively to the survival of our Nation in event of enemy attack, must not only kill enemy targets but it must provide a maximum of protection at a minimum investment using a minimum of operating personnel.

Efficient Protection Factors

Three major factors contributing to efficient protection are *coverage, rate of fire* and *kill probability* per missile salvo.

Coverage depends upon both range and altitude. The range of Talos is sufficiently long so that each Defense Unit around a city or military base can participate in engaging a threat from any direction. This range, coupled with high and low altitude capabilities, gives Talos the greatest coverage of any local defense system in existence.

A *high rate of fire* is attained by using early warning information from radar networks for mid-course guidance and by time-sharing of major components of the system. This is referred to as multiplexing. Multiplexing makes it possible for one Talos Defense Unit to engage various targets simultaneously with many missiles in the air at the same time. It can continue to fire single and multiple salvos at a high rate for an extended period of time.

High kill probability is assured by high over-all system accuracy and a lethal warhead using either high explosive or nuclear warheads.

In the design of the Talos Defense Unit, extensive effort has been devoted to the application of human engineering techniques. The Fire-Control Center, which is the heart of the Talos Defense Unit, is manned by only a few people at human-engineered consoles which provide displays of information so that the operator can easily observe and monitor the operation. The main fire-control console shows a continuous picture of the status of a multitude of engagements simultaneously. To provide an effective display, RCA has used a three-color video display screen based on color TV techniques for this important tactical application.

The Talos Defense Unit includes automatic personnel exercising equipment and system check out equipment for the over-all system. It also includes automatic check out equipment for the missile.

The automatic personnel exercising equipment is a necessity in a modern weapon system to assure maximum operator training and maximum system readiness in event of an attack. The personnel exercising portion of the system uses a variety of tactical problems, predetermined and recorded on tape. The tape is played back to feed simulated tactical engagement data to the system. The system responds automatically in the same manner that it would during an actual enemy attack. Operators can become closely familiar with the operation of the equipment under various conditions, and the operation of the equipment itself can be checked. The automatic system check out and missile check out equipments provide for rapid testing of the complete installation. In case a trouble exists, it is quickly isolated and can be corrected by replaceable printed circuit modules in the system or by replaceable packages in the missile.

Some additional advanced features of this system are:

1. *Missile Interchangeability:* The Talos Defense Unit for the Army uses the Talos missile which is identical to the missile which was developed by Applied Physics Laboratory of Johns Hopkins University and produced by Bendix for use by the U. S. Navy for shipboard Talos installations. The missiles use either high explosive or nuclear warheads. The joint use of the same missiles and warheads by the Army and the Navy for land and shipboard systems results in improved economy of the over-all Department of Defense program.

2. *Automaticity:* The Talos Defense Unit is capable of automatically handling, loading and launching the missile which eliminates the necessity of personnel in the launching area. The launcher mechanism is almost human in its movement and operation. In full automatic operation, the Talos Defense Unit operators merely observe and monitor the performance of the equipment.

3. *High Accuracy:* By using precision radars, electronic computers, programmed beam-riding missile guidance and a precise missile homing seeker, extremely high accuracy at short and long ranges as well as at high and low altitudes is provided. The Talos Tracking Radar uses the basic design of RCA's precision, long range, high power instrumentation radar (AN/FPS-16) which has been tested by the U. S. Bureau of Standards and found to be the most accurate radar in existence.

4. *High Reliability:* By the use of highly reliable components, redundancy, multiple data channels and automatic fault bypass features, high reliability is attained.

5. *Maximum Safety:* The Talos Defense Unit has been designed to provide a maximum of safety to operators as well as to nearby installations. Provision has been made so that missiles can be programmed to provide for boosters to fall in selected areas.

6. *Future Outlook:* The basic design of the Talos system provides for the extension of capabilities with a minimum of modification to assure that the system will have continued effectiveness against present and future hostile threats.

Demonstrations and Evaluations

RCA is proceeding under the direction of Army Ordnance to demonstrate and evaluate the Talos Defense Unit. RCA engineers are confident that all of its features, some of which have been mentioned above, and others which have been omitted for security reasons, will soon be demonstrated. The Talos Defense Unit demonstrates the features required in such an important defense system. In the interest of economy, RCA constructed only these items necessary to prove over-all system performance. RCA carried out all work to complete the installation on an assigned tract of land. The work included architect and engineering design of site and buildings, construction of buildings, as well as equipment development, production, installation and tests at White Sands. Several launcher firing tests have been successfully made and final acceptance tests were recently completed.

All of the military people in the Army, Navy and Air Force, the RCA people and the people of our many subcontractors who have worked on the Talos project have certainly met the challenge, which was given to RCA in early 1955, by developing and constructing the prototype installation in 33 months. All who have contributed to this program are looking forward to the day when the Army will give RCA another challenge to deliver a quantity of Talos Defense Units to the Army for field employment to fulfill the mission for which the system was engineered.

ITEMS OF INTEREST

From Government, Industry and the Services

"Power for Peace"

"Power for Peace" again is the slogan of the ninth annual Armed Forces Day when the public will be invited to take a closer look at the national defense system.

To be held on May 17, the event will emphasize the relationship between our national strength and our peaceful aspirations.

Plans are being made by major Army, Navy and Air Force commanders in the United States and overseas. A joint command, to include Marine Corps and Coast Guard, has been established to coordinate all Armed Forces Day activities in each of seven geographical areas of the United States. Overseas observances will be organized along similar lines.

2 Programs on Channel

A new method, called Bi-Tran, might provide the "scientific breakthrough to the solution of many television broadcast problems, including Pay TV, military use of existing channel frequencies, educational TV and various public service needs."

Blonder-Tongue Laboratories, Inc. of Newark, N. J., has announced an approach to television broadcasting techniques that might provide an additional program on each of the TV channels now in use.

The Bi-Tran proposal will undoubtedly require modification of present TV station equipment to enable two programs to be transmitted simultaneously on the same channel. The doubling of channel facilities would be accomplished by a method the engineers describe as a Contra-Phase Multiplexing Process. This method involves the transmission of two different pictures in the same bandwidth. A series of positive or negative signals enable picture A or picture B to be visible on the TV screen while the other picture is canceled.

If the Bi-Tran System were applied to Pay TV programming, the primary free program will be received normally by the TV receiver. The alternate program, however, would only become visible and audible by the addition of coded electronic signals. These coding and decoding signals would be carried via existing telephone wires in the home without disturbing regular telephone service. The viewer could switch to the "B" portion of the channel, thereby selecting a Pay TV program. No other action would be required. The decoding signals would be brought to the set and at the same time information would be transmitted back to the telephone central office, indicating the program selected. This feature would greatly simplify the collection of funds from the home viewers inasmuch as these funds would be added to the telephone bill.

De Vore Joins CREI

Charles De Vore, until recently the assistant technical information officer of the United States Naval Research Laboratory, has joined CREI Atomics, Inc., as Vice President and Education Director. A native of Lincoln, Nebraska, Mr. De Vore was graduated from the University of Nebraska with a degree of Bachelor of Science in electrical engineering. During World War II, he was a technical editor for the United States Signal Corps.

CREI Atomics, a newly formed subsidiary of the Capitol Radio Engineering Institute of Washington, D. C., this fall will offer the first advance home-study course in nuclear engineering technology. It is being specifically prepared for engineering and technical personnel in industry, Government and Military Services who plan to go into the field of atomic energy and its related applications.

Other officers of the organization include Eugene H. Rietzke, founder of the parent group, president; Karl O. Bathke, national sales manager; B. A. Costello, treasurer, and Hyman Goldstein, secretary.

Edison Award

A Louisiana radio amateur, who for three days provided the only communications from hurricane-devastated Cameron, Louisiana, has been presented General Electric's annual Edison Radio Amateur Award for 1957.

James E. Harrington, Lake Charles, La., operator of amateur radio station K5BQT, was judged the radio amateur who had rendered the most outstanding public service during the calendar year.

After Hurricane "Audrey" struck, Mr. Harrington, then alternate civil defense radio officer in Lake Charles, and a crew of two amateur radio assistants set up a station in Cameron and in 3 days and 2 nights handled 1,500 messages. His assistants were Capt. Neal H. Mabrey, W5VTU and Sgt. Michael J. McDermott, K5CTQ, of the Lake Charles Air Force Base.

Research Projects Hurt

Fortune magazine estimated recently that, out of this fiscal year's $1.7-billion Defense Department research and development budget, no more than $50 million has been appropriated for basic research. This figure, *Fortune* points out, is about what the U. S. spent in 1957 to bolster the price of dried milk.

According to the magazine, the lack of funds for basic research has probably cost the U. S. at least three important scientific projects. An "anti-pure-research" attitude in the Pentagon, says *Fortune*, is likely responsible for their being no work done on:

- The aerodynamics of hot gases in the 100,000-degree centigrade range—a no man's land between conventional aerodynamics and the realm of controlled thermonuclear reactions.
- Computing machines that learn from experience how to improve their own performance.
- The world's most powerful atom smasher, a 50-billion-volt accellerator that would inaugurate a whole new branch of physics.

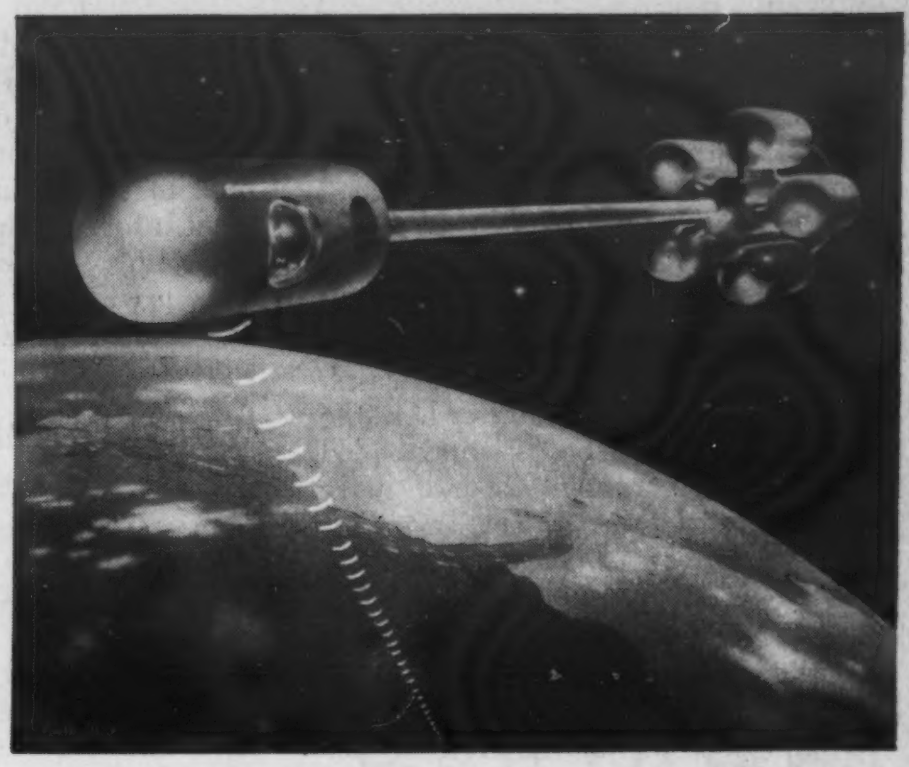
(*Fortune* reports that Soviet scientists have obtained support for an equally powerful accelerator of different design, and "they are proceeding to build it.")

The American "atom smasher" would take $80 million and five or six years of work, says *Fortune*, but the Atomic Energy Commission and the Department of Defense just "don't spend that kind of money on basic research."

A money shortage has also resulted in a "dearth" of the remarkable tools with which chemists and physicists do some of their best work, the magazine says.

Basic research, responsible for de-

TEST INSTRUMENTS Bulova's rugged Tachometer Tester for all jet and reciprocating systems meets MIL-T-945A requirements—is accurate to 0.1% with engines on or off. Simple to operate and maintain, this field unit also serves in maintenance depots. Precise Bulova testers include the dual purpose Torqmeter—a dynamometer or calibrated torque source



RECONNAISSANCE SYSTEMS Bulova-developed miniaturized sensor packages, geared to specific tactical missions, feed combat surveillance data to Bulova analysis and display systems. Camera, infra-red, TV and radar techniques, combined and integrated, aid decision-making on land and in space. Satellite applications? Unlimited!

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INFRA-RED COMPONENTS Bulova's advanced IR projects include mosaic cells that will automatically filter out unwanted wave lengths and picture targets clearly against any background. Bulova infra-red R&D covers lead selenide and lead sulfide cells, missile seeker cells, reticles, filters and thermistor bolometers...for defense and industry.

INFRA-RED SYSTEMS Bulova's IR illuminators put unseen spotlights on night objectives. Bulova's development capability extends to fire control systems that detect, track and automatically lock on target. Designed for accuracy and simplicity, these high resolution units will serve our nation's land, sea and air forces.

velopment of inventions ranging from radar to the atomic bomb, has been slighted by the Pentagon's top policy makers, who "preferred projects promising more immediate results," the publication reports.

Fortune reports that in 1955 the Hoover Commission urged that the Department of Defense increase substantially its support of basic research —"one of the few instances where the Hoover Commission recommended that the government spend more money on anything." Yet, says *Fortune*, the Defense Department has not increased its spending for basic research since 1952.

"During the intervening years inflation has so increased the cost of doing research that the Defense Department is today actually supporting 25 per cent less work than it did six years ago."

Fortune says that Congress, as a result of recent Russian technological achievements, seems anxious to supply U. S. scientists with all the money they need to keep pace with the USSR. "Certainly there will be a change for the better in the Defense Department's research policies," concludes Forture, "but how much change and how fast it will take place remains to be seen."

Draft Program for Center

A group of Stanford Research Institute scientists recently prepared a Draft Program for a National Technical Information Center.

The draft describes a program "to solve the Nation's technical information problem through the establishment of a national center for the collection, processing, storing, retrieval, and dissemination of scientific and technical information from both foreign and domestic sources."

The document further states, "An Agency of the United States should be established with the responsibility and authority to make arrangements for the conduct of research, development, and operations relating to the interim and ultimate National Technical Information Center. The Agency will employ directly a small staff consistent with its policy making, contracting and administrative functions."

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Weather Explored

In a series of five summer rocket firings for the International Geophysical Year, Army scientists explored the weather to an altitude of 60 miles. Aerobee rockets, fired from launchers at Fort Churchill, Canada, were used.

High explosive "firecrackers" built into the rocket nose-cones were employed to sound out simultaneously temperatures and winds for the first time at such altitudes. The special Aerobees were loaded with 19 high-explosive grenades, which were ejected from the nose-cone at pre-timed altitudes. The blasts were heard by delicate sound ranging devices on the ground.

The time required for the sound of the blast to reach the ground gave scientists an accurate indication of winds and temperatures. The data obtained will be made available to scientists of the more than 40 nations participating in the IGY.

Preliminary examination of the data from the firings indicates that winds of 300 miles an hour or faster are not uncommon in the stratosphere. Temperatures plunge to 100 degrees below zero, Fahrenheit, and it also appears that high altitude winds over Canada are much stronger than over the United States.

The tests were conducted by physicists of the U. S. Army Signal Engineering laboratories at Fort Monmouth, New Jersey.

Names in the News

Roy W. Johnson has been named Director of the newly established Department of Defense Advanced Research Projects Agency. He was formerly an Executive Vice President and Group Executive of General Electric.

RAdm. Frederick R. Furth (USN, Ret.), Director of Research & Development of IT&T, has been elected a Vice President of that company. Admiral Furth, current President of AFCEA, joined IT&T in 1955 following his retirement from the Navy.

Col. Percy G. Black was recently elected a Vice President of the General Telephone Service Corp. He has been Assistant Vice President in the Washington office of the Automatic Electric Co. since his retirement from the Army after World War II.

J. Z. Millar, Assistant Vice President, Development and Research, will head sales of the Western Union Telegraph Company's technical services and equipment. In addition to his present duties, Mr. Millar will be responsible for all matters involving contracts for the sale of technical services and equipment to the Government, Armed Forces and industry, and will coordinate the activities of all company representatives engaged in sales and contractual matters in this general area.

William Tucker has been appointed Chairman and Chief Executive Officer of the North Electric Co., Galion, O., a subsidiary of L. M. Ericsson Co. of Stockholm, Sweden. Before assuming his newly-created post, Mr. Tucker was President and Chief Executive Officer of the F. C. Russell Co.

J. Nelson Lord, Jr., has been assigned the newly created post of Assistant Division Manager for Military in the Industrial and Military Equipment Division at Allen B. Du Mont Laboratories, Inc. In the new position, Mr. Lord will assist with overall administration of the division's military operation and will be directly responsible for the coordination of military sales activities with contract administration.

Andrew A. Mueller was named to the new position of Chief, Engineering Laboratories, Chicago Aerial Industries. He will be responsible for all mechanical, electrical, optical and environmental laboratories and for engineering publication.

James R. Brennan has been appointed technical liaison assistant of Sylvania Electronic Systems in the Dayton, Ohio, office of Sylvania Electric Products, Inc. He joined the company three years ago as a sales representative for Government accounts at Dayton and has previously represented other Sylvania divisions in that area.

Carter L. Burgess was recently elected President of American Machine & Foundry Company. Mr. Burgess was formerly President of Trans World Airlines and from 1954 to 1956 served as Assistant Secretary of Defense for Man Power and Personnel.

Dr. Louis A. Pipes, professor of engineering at UCLA and consultant for the Hycor Division of International Resistance Company, has been named a Fellow of the Institute of Radio Engineers, an honor bestowed annually on 10 throughout the world.

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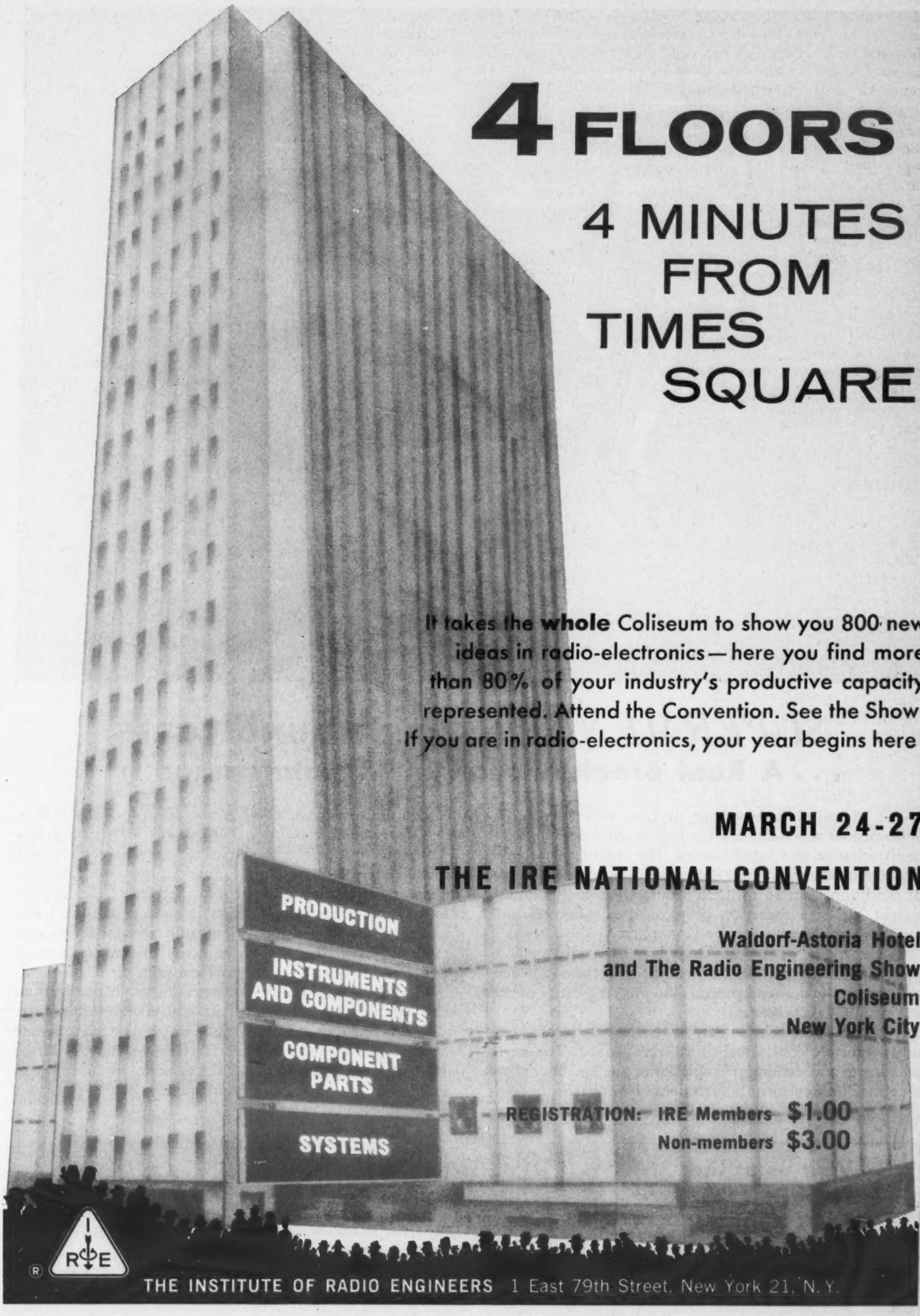

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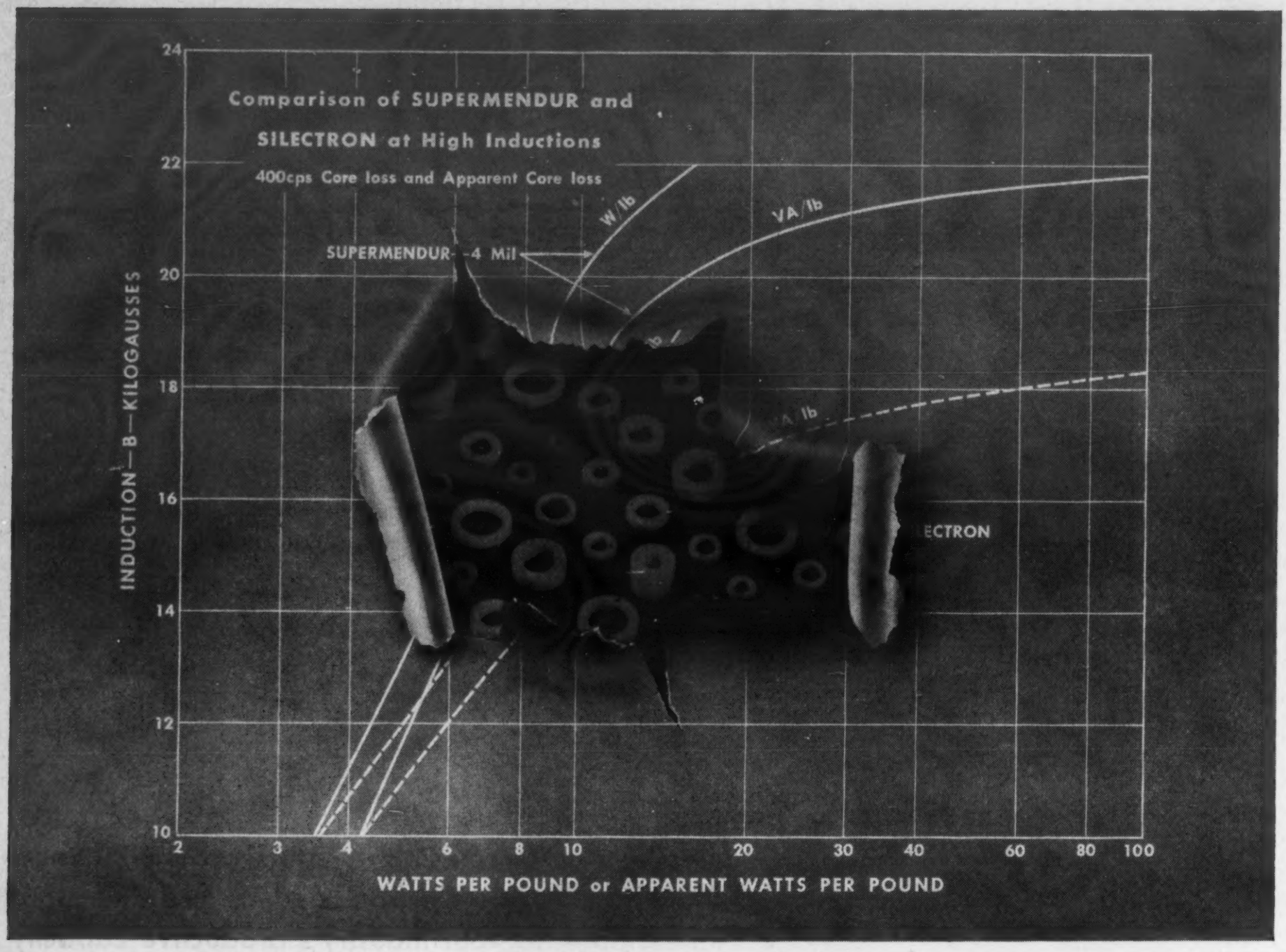

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The successful development of tape wound cores of Supermendur represents a giant step in the field of circuit miniaturization and simplification. The unique characteristics of this new rectangular-loop core material in the range of induction from 16 to 22 kilogausses permit significant weight and size reduction of toroidal transformers and magnetic amplifiers.

Supermendur, an oriented cobalt-iron-vanadium alloy, combines the high saturation flux density of the cobalt-iron alloys with the desired hysteresis loop rectangularity of the oriented 50% nickel-irons.

Coercive forces substantially lower than those of previously available cobalt-iron alloys are obtained. The lower core losses and excitation properties of Supermendur show a decided improvement in high density characteristics compared with oriented silicon steel, as illustrated by the curves partially shown above. ***Complete curves are available in a new Supermendur Bulletin TC-113, available on request.***

Specific advantages of Supermendur cores in toroidal transformers are: high operating induction, low core loss, low exciting current and high permeability at high induction. In magnetic amplifiers or saturable reactors, they include: rectangular hysteresis loop, high saturation induction and moderate excitation at high induction. Advantages in all uses are: thin tape, small size and low weight.

Supermendur is an ideal material for high temperature core components, because of its high Curie temperature.

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NEW PRODUCTS FROM INDUSTRY

Automatic Inspection of Magnetic Cores

A new, completely automatic, magnetic memory core classifier which grades cores on the basis of switching time and integrated flux from change has been announced by Rixon Electronics, Inc., 2414 Reedie Drive, Silver Spring, Maryland.

As yet unnamed, the machine accepts cores from a plastic hopper, electronically evaluates them and then mechanically discharges them into from 3 to 5 classifications bins, according to preset controls.

Although originally designed for the rigid selection of magnetic cores for use in Rixon communications equipment, the device is adjustable for core selection to any tolerance.

Approximately 1,000 cores per hour are classified by the inspection device, and elimination of the human fatigue factor is said to have reduced error to the vanishing point.

Linear Instrument Bearing

Believed to be of considerable value to defense scientists and engineers is the application of a new principle involving the new type "ball bushing" recently developed by Thomson Industries, Inc., of Manhasset, N. Y., for super-sensitive applications in inertial guidance systems of missiles and aircraft.

Designated INST-4812, the new "ball bushing" is said to be of rugged and compact design and is claimed to offer substantially lower friction, excellent repeatability characteristics and extreme sensitivity. Also, it has wide application in many types of instruments, controls and other vital components where unusually low friction linear motion is desired.

The new method discovered during the development and testing of these bearings enables them to roll down a shaft at an angle of 1 minute or less. This newly discovered method of obtaining near-zero friction unlimited travel linear support is said to allow remarkable achievements. Details will be made available to authorized people.

Memory Meter

Believed to be the first of its kind, the "memory meter" is a simple device that retains indefinitely a reading taken at any desired instant, developed by Assembly Products, Inc., of Chesterland, Ohio.

The unit is especially suitable for applications where readings must be known at a given time, but cannot be noted immediately. Such situations include remotely-located meters, or batteries of meters, with a number of different but related readings. The readings may be taken at any point on the meter scale, and not necessarily at the maximum reached by the signal.

The meter is available in almost any sensitivity range, from a few microamperes or millivolts to 50 amperes or 500 volts, either DC or AC.

New Printed Material

Continental-Diamond Fibre Corp. of Newark, Del., a subsidiary of the Budd Co., expects to enter full-scale production within 60 days of a new printed-circuit material of glass-supported Teflon tape with copper foil bonded to one or both sides, in lengths of 100 ft. or longer.

The new material is claimed to have excellent shock and vibration resistance, together with high mechanical strength, dimensional stability and excellent electrical properties.

It is used as etched flexible cable harnesses for missiles and aircraft, or as flexible connectors in multiple-array printed circuit stacks for computers and control devices. It is said certain specialized applications are also seen.

Microwave System Slide Rule

Microwave engineers at Motorola, Inc., of Chicago 51, Illinois, have developed a slide rule after having made countless calculations of path loss, antenna gain, fade margin, carrier-to-noise ratio and all the other mathematical manipulations that are required for planning a microwave communications system.

The slide rule contains 28 scales, employing both sides. One side may be used for rapid calculation of propagation characteristics and the other for multiplex calculations.

New Single Sideband Transmitter

Collins Radio Co. of Cedar Rapids, Iowa, has designed for the perspicacious amateur radio operator a 32S-1 single sideband transmitter, to be available this summer.

Measuring $6\frac{9}{16}$ x $14\frac{1}{2}$ x 11 inches and weighing 16 pounds, the unit includes such outstanding features as 175-watt PEP input, 80-40-20-15-11-10 meter bands, upper-lower sidebands, break-in CW, ALC, RF feedback, mechanical filter, VOX, and permeability tuned precision VFO. Power output is 100 watts.

Optional accessories include phone patch, directional wattmeter and built-in antenna relay.

Power Megaphone Runs On Flashlight Batteries

Powered by ordinary flashlight batteries, a fully transistorized "Power Voice" megaphone with an effective range up to ¾ of a mile has been announced by Motorola, Inc., 4501 W. Augusta Blvd., Chicago 51, Illinois.

Self-contained, water-resistant and lightweight (8 lbs.), the megaphone is ideal for all-weather activities requiring extra voice power.

Providing 15-watts amplification of power, the "Power Voice" is ordinarily held to the mouth and activated by pressing the trigger on its pistol grip handle. For longer periods of operation, it can be slung from the shoulder and used with detachable microphone.

A complete line of accessories provides operational versatility, including units for 2-speaker P.A. systems and for operation from vehicular batteries.

Microwave Frequency Meter

A new microwave frequency meter (type 587-A), featuring an extended range of 250-1000 mc per second and quick determination of frequency with ease of reading, has been developed by Polytechnic Research & Development Co., Inc., of Brooklyn 1, N. Y., for use in accurate alignment of tuned circuits and oscillators operating in the UHF TV band.

All internal resonator parts are said to be of highest conductivity materials. Because of this high Q, the PRD meter is recommended for use as a marker in the measurement of band width and frequency when visual displays are used. High accuracy, flexible operation and negligible backlash are among other features claimed for the 587-A.

The cavity and drive system are enclosed in a metal carrying case.

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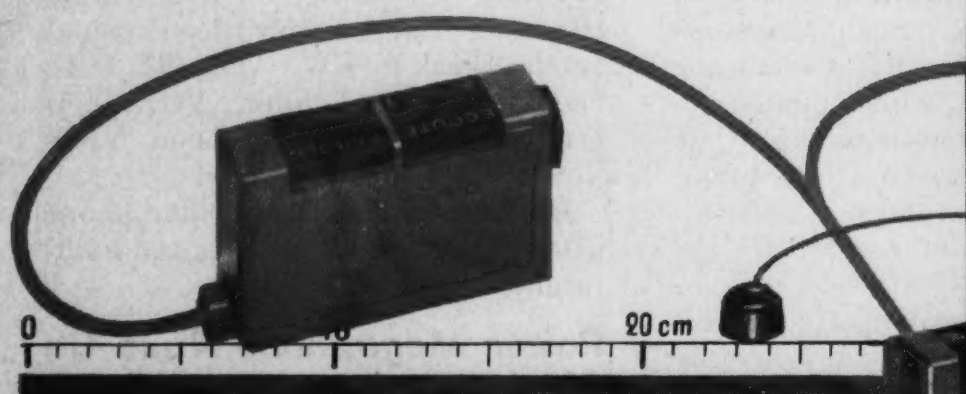

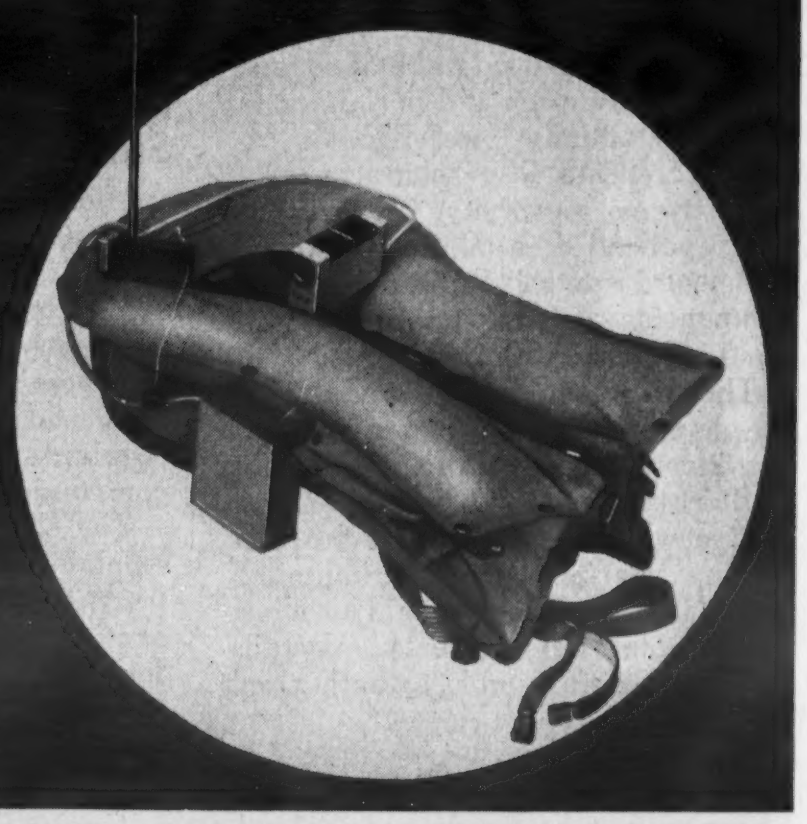

- ★ Automatic modulated beacon signal or voice (talk-listen)
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Newspaper Use of Closed Circuit Television

A small closed-circuit TV camera, produced by the Dage Television Div. of Thompson Products, Inc., 618 W. 56th St., New York, has been given, in Berkshire, Mass., a novel application in the transmission of bulletins from the news room of *The Berkshire Eagle* to the street on a 27" receiver installed at eye level.

In the news room, the camera is focused on the large revolving drum where bulletins are placed. In addition to the type used for news flashes, anything can be televised to the street, including editors reading election returns, etc., or photographs received from the wire services.

Magnetic "Mini-Lux"

A tiny magnetic microphone called the "Mini-Lux," measuring ½ x ½ x ¼ inch, has been made available by Shure Bros., Inc., 222 Hartrey Ave., Evanston, Illinois.

The unit is said to replace much larger microphones without appreciable loss in over-all performance and is believed to be of considerable value to designers in the planning of compact, transistorized devices.

Printed Circuitry Brochure

At no cost, a new brochure containing full descriptive data on printed circuitry as to materials, specifications, design tolerance and application information may be obtained from Printed Electronics Corp., North St. Natick, Mass.

Description of the patented Narcus process for plating holes is given and an enclosure bulletin on the Protomaka details the use of such equipment for production of printed circuits in one's own plant in a matter of minutes.

Closed Circuit TV Booklet

Entitled "What Closed Circuit Television Means to You," a new 16-page booklet is available from Blonder-Tongue Labs., Inc., 9 Alling St., Newark 2, N. J., describing their present CCTV systems and offering a comprehensive presentation of typical CCTV camera systems, applications and equipment.

The highly illustrated booklet focuses attention on the benefits and economies of CCTV for small businesses as well as for education, medicine, traffic control, production control, safety engineering, quality control, material handling, store promotions, banking, and railroads and transportation. Examples of CCTV applications where miniature cameras are used are also provided.

FCC Study Report

A report on network broadcasting, submitted by the Federal Communication Commission's special network staff last October, is now available, at a cost of $2.00 per copy, from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Economic Almanac

Copies of the 1958 Economic Almanac, prepared by the National Industrial Conference Board, may now be had at the price of $5.00 each from the Thomas Y. Crowell Co., 432 4th Avenue, New York.

Including a glossary of economic terms, the publication contains 558 pages of statistical tables which are considered by the board to be "most widely and commonly wanted and used in connection with current economic and management questions."

Soviet Science Data Released

The U. S. Government will release for immediate public use more than 50,000 Russian scientific documents a year, the bulk of which will be made available by the Central Intelligence Agency and the Air Force's Air Information Division.

Every agency in the Government which now translates such Soviet literature has agreed to take part in the plan.

Previously stamped "secret" either for reasons of security or lack of funds to meet costs of sufficient supply and distribution, that now to be released first is current literature which has been received and translated within the past year.

Sputnik Impact Reviewed

Mr. Richard Witkin, aviation editor of the *New York Times*, has edited a newly-published 96-page book entitled "The Challenge of the Sputniks."

Designed to provide a varied range of reactions to the Soviet achievements, Mr. Witkin has compiled, and linked together with cogent commentaries, various important articles, interviews, public documents, and selections from foreign press.

Together with a significant introduction and a preface to each selection by Mr. Witkin, opinions from Finletter, Lippmann, Eisenhower, Gardner, Baruch, Clare Booth Luce, Reston, von Braun and others provide an authoritative look at Sputnik's impact on the Western world.

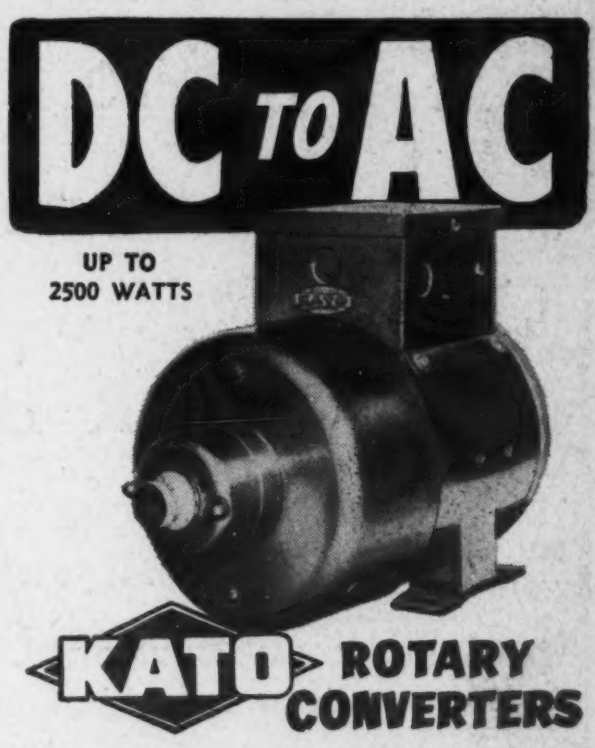
Doubleday & Co., Inc., of Garden City, N. Y., is the publisher and the cost is $1.50.

Photodrawing Booklet For Engineers

Available from the Sales Service Div. of Eastman Kodak Co., Rochester, N. Y., a new 12-page illustrated booklet describes a simple technique of using photographs to convey engineering drawing information, guaranteeing a saving in time and money as compared with other methods.

The procedure involves reproduction of photographs on a translucent material on which engineering detail and superimposed sketches may be added. From this master photo-drawing, work prints can be made by conventional methods.

Designated "Photodrawings" (P-22), the booklet offers 2 different methods of preparing photodrawings, thus enabling their use in various areas of industry including assembly, inspection and engineering.



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Books

MAN UNAFRAID, by Stephen F. Tillman. Army Times Publishing Co., Washington, D. C. 228 pages, $4.00.

Enjoyable reading of historical value is offered in Steve Tillman's absorbing book which treats the early days of military aviation, between 1907 and 1916, when the creation of an Aeronautical Division within the Army Signal Corps inaugurated man's organized efforts to fly. Notes are numerous and a wealth of excellent photographic reproductions enlivens the author's narrative. The U. S. Military Academy deserves noteworthy recognition for making available to Mr. Tillman the many valuable prints picturing early Academy graduates who, among others, played a vital role at the birth of military aviation.

The circumstances surrounding the Army's initial disinterest in the Wright brothers' flying machine; the eventual organization of an Aeronautical Division; the long road to perceiving the obsolescence of the fort, despite the somewhat obvious potential of the aeroplane for scouting and reconnaissance; the editorial reaction, in 1912, to Lewis' "most murderous invention," the machine gun for use in the aeroplane — these, as are the many events in the early growth of military aviation, are vividly detailed, not without interesting sidelights.

Man Unafraid unstintingly lauds the initiative of those first pioneers and Army organizers whose foresight envisioned the military potential of a future field of aviation; yet, it can be inferred that the work is, in addition, a tribute to those of the Air Force, as we know it today, whose contributions advanced the growth of air power to become one of our Nation's most vital defense organs.

A life interest and hobby has indeed been culminated with this fine account by our author, "Little Stevie" (see picture on p. 34) whose early enthusiasm in military progress was only natural, being the kin of one of West Point's most distinguished Superintendents.

HIGH-SPEED PHOTOGRAPHY, Vol. VI. Society of Motion Picture and Television Engineers, New York 36, N. Y. 200 pages, 6" x 9", paperbound, $3.50.

High-speed photography has meant many things to many industries, as evidenced in the latest volume of the SMPTE's reprint series. Comprised of selected papers which have appeared in the Society's *Journal* since 1954, the new book contains 27 articles beginning with a description of a tracking telescope type of optical recording instrument for missile programs at White Sands Proving Ground.

Other articles offer information on photography and equipment for guided missile research, light sources, electronic timing devices, special films, and methods for analysis for high-speed data. Two papers from the Rochester School of Medicine and Dentistry describe developments of 16mm projectors for research films. A color schlieren system for high-speed photography is illustrated in full color and the work ends with an 8-page cumulative contents index of the 120 articles appearing in all 6 volumes of this series.

THE SPACE ENCYCLOPAEDIA, E. P. Dutton & Co., Inc., New York. 293 pages, $6.95.

Since the exploration of space would be of narrow significance if one were not to look beyond his local adventure for some understanding of the universe as a whole, Dutton & Co. has compiled a new space reference volume which combines a complete survey of all branches of astronomy with a wealth of detailed information on guided missiles and upper-atmosphere research.

Abundantly illustrated and thoroughly cross-referenced, the encyclopaedia offers articles on astronomy, cosmology and radio astronomy and on guided missiles and rocketry as recommended general introductions to their respective subjects.

As guaranteed by the outstanding contributors to the volume, a complete avoidance of speculation is assured.

THE BRIDGE AT REMAGEN, by Ken Hechler. Ballantine Books, Inc., New York. 238 pages, paper-bound, 50¢; hard-bound, $4.50.

Ken Hechler's book depicts a most gripping adventure of military daring in his authentic account of the courage exhibited by those few Americans who, on March 7th, 1945, were confronted with the stark situation of being the first to cross the bridge at Remagen.

On the scene as combat historian, the author had means of gaining authoritative research on the surprise crossing of the Rhine. Based on extensive interviews with both German and American participants, the story rings with realism and human interest.

The crossing was a risk boldly accepted by a relatively small number of men who, together with almost incredible luck, changed the course of war. The consequences of this feat were fully spelled out later by Gen. Dwight Eisenhower in his *Crusade in Europe:* "We were across the Rhine, on a permanent bridge; the traditional defensive barrier to the heart of Germany was pierced. The final defeat of the enemy, which we had long calculated would be accomplished in the spring and summer campaign of 1945, was suddenly, now, just around the corner."

PANMUNJOM: THE STORY OF THE KOREAN MILITARY NEGOTIATIONS, by William H. Vatcher, Jr. Frederick A. Praeger, Inc., New York. 322 pages, $4.75.

Panmunjom, the scene of the momentous Korean armistice conferences, has been considered as the turning point in the Communistic effort to force revolutionary dogma on a world which regards resistance to such force simply as fundamental to civilized life.

Carefully documented and well illustrated, Professor Vatcher's book approaches a study of the negotiations at Panmunjom chronologically. Attention is placed on the actual events with discussion of the benefits to be derived from such experiences, rather than treating the affair specifically as a problem of the United Nations.

Having served as a member of the UN negotiating team during the conferences, having had access to official records and having associated with principal figures involved in the proceedings, the author has written what is considered an accurately definitive work in his illuminating account of the struggule for a "ceasefire," of the forces at work impeding its realization and of the final agreement.

Including 6 appendices, the volume provides a statistical summary, a day-by-day chronology of the negotiations and a copy of the final agreements.

MIC (*Continued from page* 35)

The Conference featured many of the country's foremost "thought leaders." Every session was attended by a packed audience of approximately 1200 spokesmen for commerce, industry, government, scientific and professional fields, higher education and the Armed Services.

An interesting feature was the attendance of 100 senior high-school students representing schools in the Chicago area, with the approval of the Chicago Board of Education.

The Military-Industrial Conference is to be congratulated for its unsurpassed effort to identify the role of commerce and industry in developing, mobilizing support for, and accomplishing "a realistic national strategy for the United States."

Weathervision Inaugurated First in Nation's Capital

Air Force officially opened the nation's capital's first weathervision installation on March 5, 1958 at Andrews Air Force Base, Md.

Weathervision is the use of closed-circuit television to speed weather information to pilots and planners on the widely scattered jet-age Air Force base. The system was devised for the USAF Air Weather Service by the Dage Television Division of Thompson Products, Inc., of Michigan City, Ind.

The weathervision system includes a central console at the base weather station and 11 receiver sites dispersed about the large base.

Air Force guests invited to the opening ceremony also attended a briefing by the 95th Fighter-Intercepter squadron, which flies Convair F-102 Delta Dagger jet aircraft in defense of the nation's capital. Weather information for the briefing was transmitted to the fighter squadron's briefing room by weathervision.

Weathervision experts from Andrews and from the Dage Television and Air Weather Service conducted guests throughout the weathervision tour.

Weather experts believe that, by providing instantaneous weather briefings by television from a central site, weathervision promises to increase the future effectiveness of modern military weathermen.

Air Weather Service expects to make additional use of weathervision in its task of providing global weather support to Air Force and Army units wherever they serve throughout the world.

A story on the advantages of weathervision by John R. Howland, National Vice President of AFCEA and member of the Dage organization, will appear in a subsequent issue of SIGNAL.

Convention Committee Meets

On March 10, the 1958 Convention Advisory Committee and the committee chairmen met in the Office of M. C. Richmond of Western Electric in Washington, D. C., to discuss further plans for the annual AFCEA Convention to be held in June.

One of the Convention events which was discussed was the Buffet Supper to be held on Wednesday eveing, June 4, at 7:45 p.m. John Gilbarte, chairman of the entertainment committee, has announced that this will be a gala affair with a program of entertainment designed to make it one of the highlights of the Convention. Be sure to reserve a place for yourself and your guests.

According to Mr. Gilbarte, it will afford you an opportunity to repay social obligations and "You'll have an evening of relaxation to remember."

For a complete program of events for the Convention, see page 11.

Acid Test (*Continued from page* 19)

If we can inspire a national determination to achieve the ultimate victory, all other factors will fall into their proper perspective and places. We will then move forward, a united people, into an age in which the far reaches of the universe will become as familiar as the next town.

It is disquieting to be asked: "But what will all this profit us?" Such questions betray a lack of confidence and, even more serious, the kind of unenlightened approach which has hamstrung our progress in the past. No man can say with assurance what benefits will accrue from our discoveries. With Explorer we made a modest beginning. We have stepped into a new, high road from which there can be no turning back. As we probe farther into the area beyond our sensible atmosphere, man will learn more about his environment; he will understand better the order and beauty of creation. He may then come to realize that war, as we know, it, will avail him nothing but catastrophe. He may grasp the truth that there is something much bigger than his one little world. Before the majesty of what he will find out there, he must stand in reverential awe. This, then, is the acid test as man moves into the unknown.

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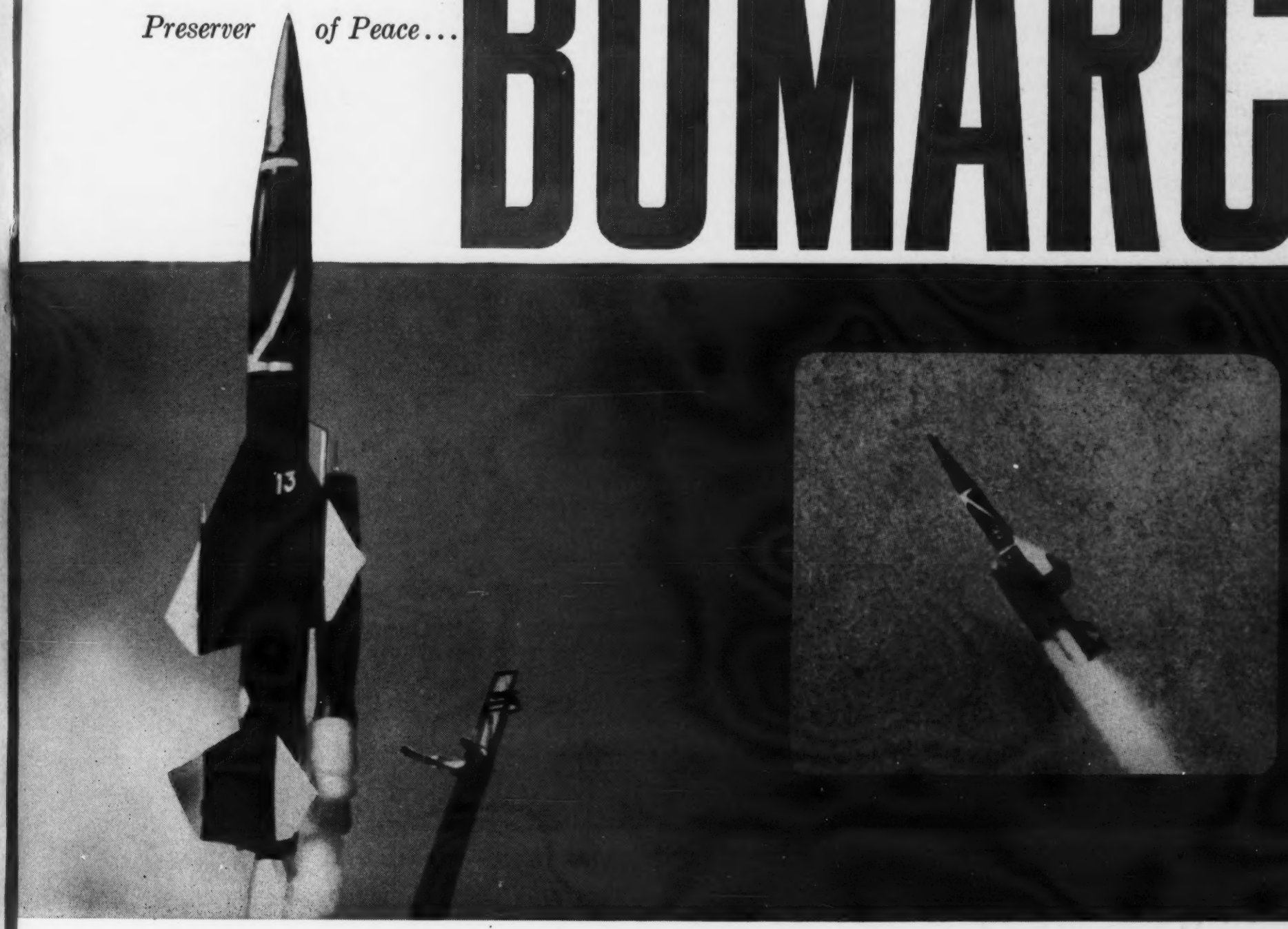

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Memamadun (he was the only survivor) was brought before Cleopatra.

"Can you give me any reason why I shouldn't throw you to my pet crocodile Julius for letting such a terrible thing happen?" she asked.

Memamadun stifled a yawn.

"Even if I'd been awake, our radar wouldn't have prevented the attack," he said. "Our radar won't work."

"Why not?" the queen asked, stroking Julius' head.

"It can't," Ptolemy ptold her. "For one thing, Bomac tubes haven't been invented yet."*

"That's right, too!" Cleopatra said. "Case dismissed."

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